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FEBRUARY 1999
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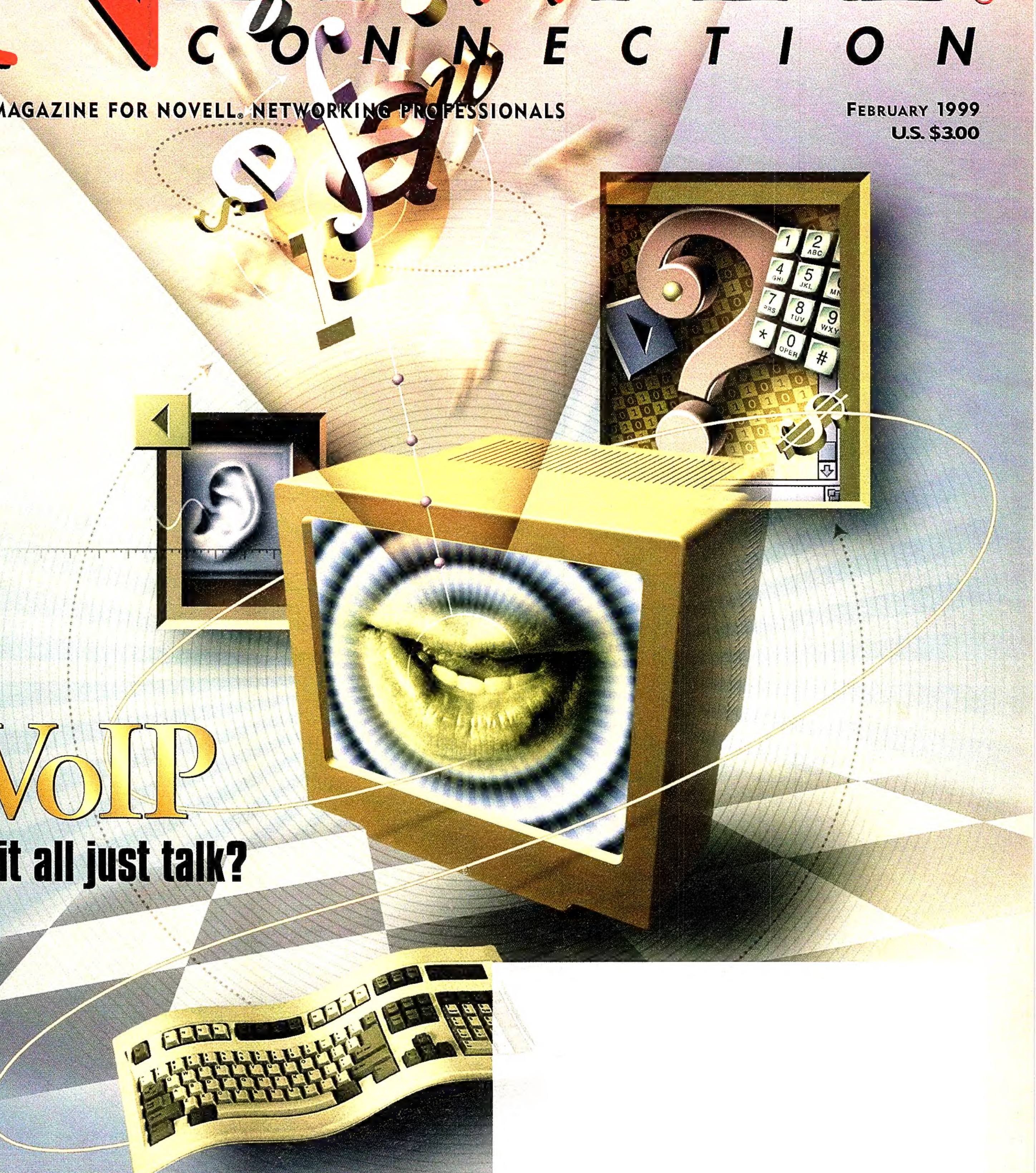

VoIP

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The Magazine for Novell® Networking Professionals

February 1999

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Is your company talking about VoIP or should it be?

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6 Sound Solutions: Defensible VoIP Options for Companies

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20 NetWare 4.2: Expanding Your Choices

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NOVELL CERTIFIED PROFESSIONAL

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48 Online Connection: Who Are the People in Your Neighborhood?

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Tom White

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***NetWare Connection*, February Issue, Volume 10, Number 2**

POSTMASTER: Send address changes to *NetWare Connection* (ISSN 1076-3422), P.O. Box 19007, Provo, UT 84605-9007. Allow four to six weeks for your subscription to begin.

Canada Post Publication Mail Sales Agreement No. 1381296
Canadian Return Address: 2744 Edna Street, Windsor, ON N8Y 1V2

NetWare Connection (ISSN 1076-3422) is published monthly by NetWare Users International Inc., 1555 North Technology Way, Orem, UT 84097, 1-801-465-4768. Periodicals Postage Paid at Orem, UT and at additional mailing offices.

NetWare Connection is published 12 times a year. Subscription cost is U.S. $36 per year.

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LETTERS TO THE EDITOR

More Information About NetWare 4.11

I found the article about Novell Client 3.01 for Windows 95/98 in the December issue particularly useful ("NetWare 5 Client Software for Windows 95 and 98," *NetWare Connection*, Dec. 1998, p. 40–42). I would like to see more articles like this one that address NetWare 4.11 and the Novell client software. The majority of NetWare administrators are still running NetWare 4.11 (or older) networks. Please do not neglect us. Information concentrating on NetWare 5 is useless to me.

Thanks,
Andre Caesar

Thanks for the feedback. Addressing the needs of all of our readers can be challenging. In each issue, we try to include information that you can use today and information that helps you plan your company's future. We'll keep your comments in mind and try to provide more information about NetWare 4. In fact, if your company is running NetWare 3.x or NetWare 4.11, you may want to check out the article about Novell's recent release of NetWare 4.2 in this issue (p. 22).

The Thrill of Victory

I read in the December issue that Novell has released Novell Directory Services (NDS) Integration for PeopleSoft ("Novell News," *NetWare Connection*, Dec. 1998, p. 43). I just wanted to say "hooray!" In the past several months, my company has spent several million dollars on server and software upgrades, including some PeopleSoft modules based on Oracle8 database servers. All of this is going to be set up on a homogeneous Windows NT environment, which I have been against from the start. This small article lends credibility to my point: You can't sacrifice a time-proven technology like NetWare for a workgroup solution like Windows NT. I can't tell you how good this makes me feel. "Ah sweet victory."

Thank you,
Travis Rath

A Recipe for Success

My compliments to the "chef." I just want to say thank you for the effort and the time that you put into *NetWare Connection* magazine. It continues to be short, accurate, to the point, and very much instep with current events and issues.

Thank you,
Bill North

A Word About Your Privacy

First, I would like to say you have a great web site. Second, I have a question regarding the online subscription form for *NetWare Connection* magazine. I am a recent CNE, heading for Master CNE status, and I would like to receive a free subscription to *NetWare Connection*. I have completed the online application form with the exception of the birth month. I don't see the relevance of such information. I also noticed that the mail-in subscription form does not ask for the birth month. Why does the online subscription form ask for this information?

Just curious and concerned,
Jeff E. Cantrell

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Article Proposals. We accept articles from NetWare users. Please send a proposed outline via e-mail to dpearson@novell.com, or mail the outline to Debi Pearson, *NetWare Connection*, P.O. Box 19007, Provo, UT 84605-9007.

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DEFENSIBLE VOIP OPTIONS FOR COMPANIES

Linda Boyer Kennard

When asked, "How are network administrators responding to voice over IP (VoIP)?" *NetWare Connection*'s sources provided conflicting viewpoints. For example, Jeff Tyre, product manager of Nortel Networks' V/IP Phone/Fax IP Gateway, claims that network administrators are "really enthused" about VoIP. Similarly, George Moore, vice president of sales and marketing at StarVox Inc., believes that network administrators are "absolutely excited" about VoIP.

In contrast, Thomas Nolle, president of CIMI Corporation, a technology assessment firm, paints a picture of disinterest. To illustrate his point, Nolle describes an April 1998 conference during which he addressed a group of corporate information officers (CIOs) who represent 100 of New York's largest companies. Nolle asked these CIOs if they were carrying voice over their IP networks or if they would be in the near future. According to Nolle, not one of these CIOs answered in the affirmative. In fact, Nolle reports that one CIO said he felt no need to risk his business by subjecting it to the "unknown voice quality" associated with VoIP.

Nolle's informal survey supports Sara Hofstetter's hypothesis that "only two or three Fortune 1000 companies have implemented VoIP on a corporate level." Hofstetter is the director of public relations for Integrated Device Technology (IDT) Inc. Despite this hypothesis, however, Hofstetter believes that VoIP is worth getting excited about. As Hofstetter explains, VoIP "is a fantastic opportunity" for companies.

With inconsistent responses such as these, you may not know what to think about VoIP. Is VoIP a great opportunity or a great risk for your company? Because you don't know the answer to this question, you may be justifiably wary about VoIP—but you should still be interested in VoIP. Why? Because some, but not all, VoIP solutions are sound solutions for corporate networks—solutions that deliver good voice quality and promise significant cost savings. However, whether VoIP solutions are defensible options for corporate networks depends on the type of voice communications you're talking about and the type of network over which you plan to carry voice. What you need to know is which types of VoIP solutions you should check out—and which ones you should chuck out. (For a list of VoIP solution providers, see "VoIP Equipment Vendors and Service Providers" on p. 18.)

VOICE OVER THE INTERNET—THE SOUND AND THE WORRY

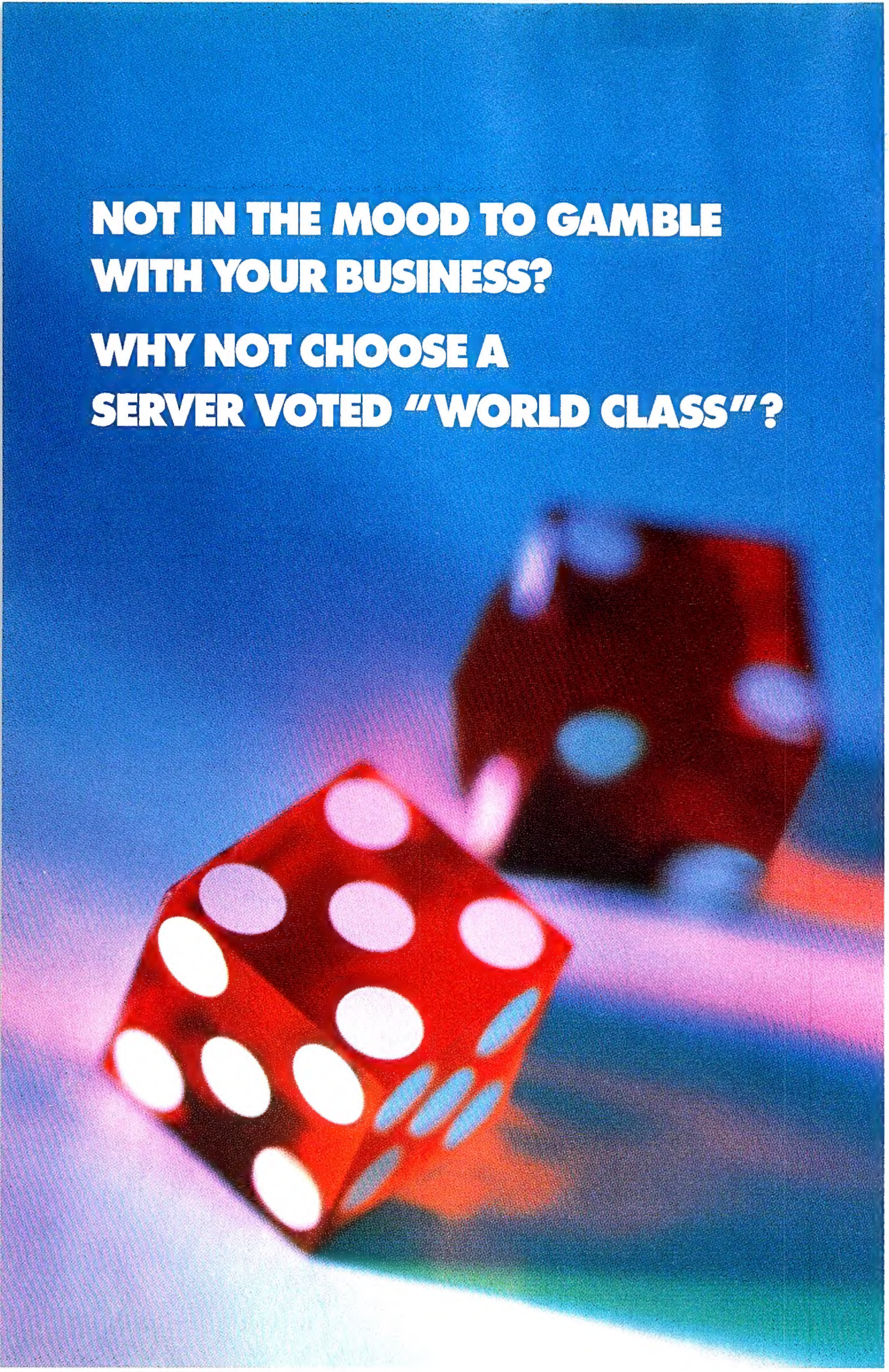
VoIP is industry jargon that refers to the ability to digitize and compress voice and then compile it into packets for transport over a public or private IP data network. Some people broaden the scope of VoIP by using it to include the transport of streaming audio files, which you can download from an intranet or the Internet. In contrast, other people (including a few members of the press, some VoIP service providers, and a handful of industry analysts) unintentionally restrict the scope of VoIP. These people use Internet telephony and VoIP interchangeably, implying that VoIP refers only to the transport of voice over the Internet. Generally, however, VoIP refers to the transport of real-time conversational voice (or fax) over a private intranet, a publicly managed IP network, or an unmanaged public IP network, namely, the Internet.

Most people agree that carrying voice over managed public or private IP data networks is a viable corporate alternative to maintaining separate voice and data networks. (A few people do argue rather loudly against this idea.) However, most people also agree that carrying voice over the Internet is not a viable corporate alternative.

With the exception of one or two useful voice-over-the-Internet applications, the Internet, most people agree, is not ready now, nor will it ever be ready, to carry voice traffic for companies. Companies demand toll-quality voice, that is, voice that sounds like voice over the Public Switched Telephone Network (PSTN). In other words, companies demand a quality of voice that the Internet simply cannot provide.

Even die-hard VoIP advocates such as Jeff Pulver, president of an Internet-based consulting firm called pulver.com, freely admit that the Internet will never make it as a corporate alternative to the PSTN: "Whoever said that [the Internet] had to?" asks Pulver in exasperation. Widely recognized as an expert in the VoIP industry, Pulver explains that companies would be remiss to bother with VoIP over the Internet. "Quality of voice over the Internet today may be the best you'll ever hear it," Pulver says, quickly adding that, at best, "that quality is predictably unpredictable." Pulver maintains that it "makes no sense" to put a company at risk by subjecting its voice traffic to "an environment where

Illustration: Tom White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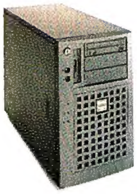

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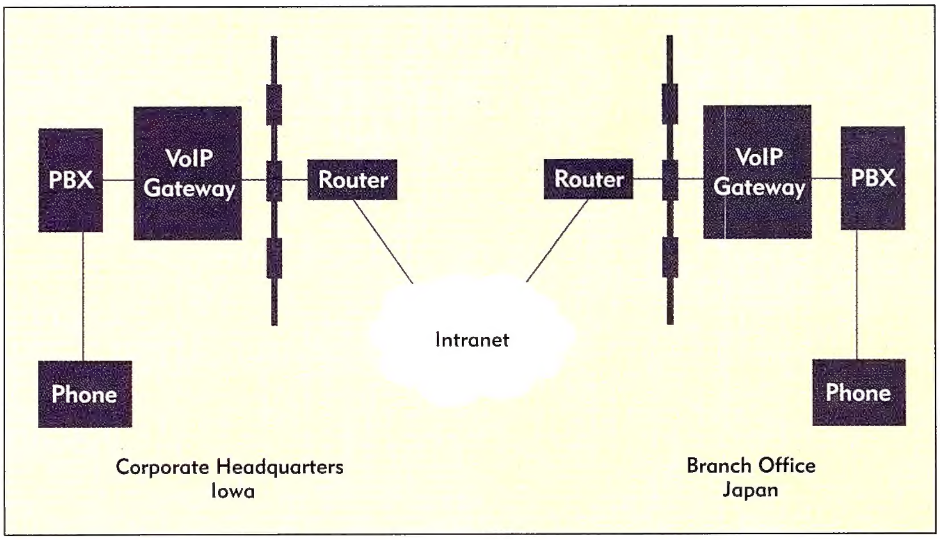

Figure 1. *A basic VoIP gateway solution*

you can't control the quality." Pulver concludes, "Voice over the Internet is best to sold to people who don't care about quality." (For more information about pulver.com, Pulver's company, visit http://www.pulver.com.)

Is Predictably Unpredictable Quality Acceptable for Fax?

Despite its limitations, the Internet is not totally useless as a corporate telephony vehicle. For example, companies can plausibly use voice over the Internet to enhance their World-Wide Web sites. (For more information about enhancing your company's web site with VoIP applications, see "Give Your Company's Web Site a Voice" on p. 10.) In addition, companies can use VoIP applications, such as PSINet's InternetPaper, to route fax transmissions over the Internet.

However, whether or not the Internet provides a suitable environment for fax transmissions is open to dispute. Some VoIP equipment vendors and VoIP service providers, including Nortel Networks and Delta Three, believe that faxing over the Internet is a legitimate option for companies. However, other VoIP equipment vendors, most notably Lucent Technologies, clearly disagree.

In a white paper titled "The Market for Internet Telephony," Delta Three actually implies that faxing over the Internet is better than faxing over the PSTN. (You can download this white paper from http://www.deltathree.com/company/press/whitepaper.asp.) As Delta Three reports, "some 28% of outbound international faxes from the United States failed on the first transmission attempt." With Internet-based faxing, on the other hand, the VoIP gateway closest to the recipient can try the transmission repeatedly until that transmission succeeds, "meaning that the sender need only stand at the fax machine once." ("The Market for Internet Telephony," p. 2.)

In contrast, in a white paper titled "Impact and Performance of Lucent's Internet Telephony Server (ITS) Over IP Networks," Lucent Technologies implies that the Internet is worse for fax transmissions than it is for voice traffic. (You can download this white paper from http://www.lucent.com/enterprise/internet/its-e/documentation.html#white.) According to Lucent's white paper, "network performance requirements for fax over IP [are] more stringent than [the requirements for] voice over IP." (P. 7.) Whereas a one-way packet delay of up to 400 milliseconds is tolerable for voice traffic, a one-way packet delay exceeding as few as 300 milliseconds is "unacceptable" for a fax transmission. (Pp. 8–9.) (Lucent also notes that for both voice and fax, delays of fewer than 200 milliseconds are preferred.)

Despite the discrepancies in the claims of VoIP equipment vendors and service providers, applications for transmitting fax over the Internet might be worth looking into—particularly if a considerable portion of your company's phone bill is for international faxing charges. For example, if your company's phone bill rivals phone bills for Fortune 500 companies, you might want to look at Internet telephony alternatives to faxing over the PSTN. According to Pulver, 40 percent of the charges on phone bills for Fortune 500 companies are charges for international fax transmissions. Consider how much your company could save if every one of those international fax transmissions were free (after the initial cost of the Internet fax application, of course).

A Few Extra Digits to Save a Few Extra Pennies

Although the Internet is not ideally suited for carrying voice and fax traffic, most people in-the-know agree that public IP networks and private intranets are very well suited for carrying voice and fax. A wide range of VoIP solutions for public and private IP networks are available, but not all of these solutions are appropriate for your company.

For example, several next-generation telephone companies (telcos), including Delta Three, Qwest Communications, and IDT, are building their own IP networks over which customers throughout the world will eventually be able to exchange voice, data, and even video. These telcos currently offer VoIP phone-to-phone services, such as Qwest Communications' Q.talksm and IDT's Net2-Phone Direct. These long-distance services route voice and fax traffic over a managed IP network, rather than the PSTN, and purportedly save money. To use these services, however, you must dial into the telco's IP network before dialing the number you are trying to reach.

Although the exact steps vary between services, placing a call using one of these services would involve the following basic steps:

1. You dial into the service provider's network using a local access number, a long-distance number, or a toll-free number.
2. You enter a personal identification number (PIN) or an account number.
3. You dial the number you are trying to reach (including the area code).

Depending on the size of your company and the price breaks your long-distance carrier offers, this type of service can save your company money. For example, such solutions might appeal to small companies because they typically don't get the same price breaks from long-distance carriers as larger companies get. Hence, the rates the next-generation telcos offer might be

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Give Your Company's Web Site a Voice

"Regardless of how sophisticated your web site may be," Integrated Device Technology's (IDT's) Click2Talk web site reads, "razzle-dazzle graphics are no substitute for human contact when it comes to closing a sale." (You can access IDT's Click2Talk World-Wide Web site at http://www.click2talk.com.) Human contact between customers and your company's sales representatives is precisely what IDT enables with Click2Talk.

Click2Talk is one of a new breed of VoIP applications that give your company's web site a voice. If you add the Click2Talk icon to the web site, visitors can click that icon to speak—over the Internet—with one of your company's sales representatives. A visitor needs only a multimedia computer and IDT's Net2Phone software, a PC-to-phone application. (You can download free Net2-Phone software from http://www.net2phone.com.)

Your company's sales representatives need only telephones. They don't need to be online. In fact, they don't even need a computer. Yonah Lloyd, director of IDT's Click2Talk division, explains that Click2Talk provides "real-time voice communication that originates online from any PC anywhere in the world but terminates on a standard telephone."

The value of Click2Talk lies in its potential to secure sales by enticing two types of customers your company might otherwise lose:

- Customers who are reluctant to enter personal, financial information on the Internet
- Customers who are reluctant to pay for international calls to purchase something

According to Lloyd, a company might be losing sales as a result of people's fear of the Internet. "Most people don't want to throw around personal information, especially credit card information, on the public Internet," Lloyd suggests. Lloyd's implication is ironic but true: Most people feel more comfortable giving their credit card information verbally than they feel giving that information in writing—even though that information, whether verbal or written, is carried over the same lines, in this case, Internet lines. Thus, when faced with entering credit card information to complete a purchase online, many potential customers leave the web site and your company loses the sale. But if these would-be customers could click an icon to speak with an actual person, they might just stick around long enough to complete the purchase.

Expensive international calls might also create barriers between your company and its potential customers. Using Click2Talk, overseas customers can place a free phone call to purchase something they see on your company's web site.

Adding the Click2Talk icon to your company's web site, according to Lloyd is "a no-brainer. . . . It takes about one minute." After you add the icon, the rest is up to your customers. What happens after a potential customer clicks your Click2Talk icon depends on whether or not that customer already has IDT's Net2Phone.

If a customer who already has Net2Phone clicks the Click2Talk icon, "the Net2Phone software automatically dials the preprogrammed phone number," Lloyd explains. Within seconds, that customer is talking to one of your company's sales representatives. However, most Internet users do not have Net2Phone—not yet anyway. IDT is working to ensure that more people get Net2Phone. In fact, "within the next six to 12 months," Lloyd projects, "pretty much anyone buying a computer from most of the major manufacturers [in the U.S.] and around the world will have Net2Phone."

If a customer does not already have Net2Phone, he or she will have to download Net2Phone before using Click2Talk. Companies that add the Click2Talk icon to their web sites include a line of text that says something to this effect: "In order to use Click2Talk, you must have Net2Phone. If you do not have Net2Phone, click here."

When potential customers click on the hypertext link, Net2-Phone is automatically downloaded, free of charge and pretty quickly. The Net2Phone package is approximately 1.3 MB, which takes about five to six minutes to download for users with only 28.8 connections. Once the customer has downloaded Net2Phone, he or she can click the Click2Talk icon to speak with one of your company's representatives.

As the main article points out, most people agree that the Internet is not up to corporate standards in terms of voice quality. Not surprisingly, the quality of Click2Talk voice traffic doesn't exactly rival the quality of calls over the Public Switched Telephone Network (PSTN). In fact, the quality of Click2Talk voice is "probably similar to cell phone quality," admits Lloyd without apology. When you use Click2Talk, Lloyd continues, "You know for sure that you're not talking to somebody on a full standard phone, but you can still have a conversation." However, Click2Talk users are home users, who are far less concerned about voice quality than corporate users.

According to Lloyd, more than 100 companies are already using Click2Talk, including Andrea Electronics (http://www.andreaelectronics.com/product.htm), 1-800-FLOWERS (http://www.1800flowers.com/flowers/help/clicktotalk.asp) and Sheraton Boca Raton Hotel (http://www.sheratonboca.com). You may want to visit one of these web sites and try out Click2Talk yourself.

better than your company's current rates. IDT, which controls nearly 30 percent of the IP telephony services market, charges as few as 5 cents per minute for state-to-state calls that you place using its Net2-Phone Direct services and as few as 10 cents per minute for international calls.

On the other hand, this type of service might be impractical for your company, regardless of its size. After all, your company can reap the savings these services offer only if employees use the service. So before researching your options, ask yourself this question: Could you really train employees to consistently dial all of those extra digits before dialing the number they are trying to reach?

GATEWAYS BREAK THE SOUND BARRIER

One of the most practical VoIP solutions for companies of any size is a gateway solution. VoIP gateway solutions enable you to place calls between branch offices for free or for exceptionally low rates—after the cost of the gateway solution itself, of course. If your company already has an intranet, you might opt to purchase a gateway solution from a VoIP equipment vendor, such as Nortel Networks or StarVox.

Nortel Networks' V/IP Phone/Fax IP Gateway offers small- to medium-sized companies a way to route voice and fax traffic between offices over their private intranets. You can install the V/IP

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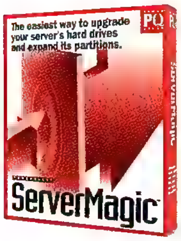
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G.729 codec bandwidth		8 kbit/s
IP router overhead	+	2–7 kbit/s *(2 kbit/s with router header compression; 7 kbit/s without router header compression)*
Total Bandwidth		**10–15 kbit/s**
Less 60 percent silence	–	6–9 kbit/s
Net codec bandwidth consumption averaged over a 20–30 second period		**4–6 kbit/s**

Figure 2. *Using silence compression, a G.729 codec can cut its bandwidth consumption in half. (This information is taken from Nortel Networks' "Voice/Fax Over IP," p. 36. You can download this white paper from http://www.micom.com/WhitePapers/index.html.)*

gateway on a 486 or above server running NetWare 3.12 or NetWare 4.x, or you can install the V/IP gateway on another supported operating system, such as Windows 95.

The V/IP gateway is the only VoIP gateway available today that runs on NetWare servers. (However, Lucent Technologies plans to make its IP ExchangeComm System support NetWare 5 soon.) In addition to being connected to your company's intranet, the V/IP gateway connects to your Private Branch eXchange (PBX) or key telephone system via analog and digital voice interface cards (VICs).

StarVox's StarGate Server is best suited for companies with at least 10 offices, particularly if some of those offices are in other countries. Like the V/IP gateway, StarGate Server enables you to route telephone calls between sites over your company's intranet links.

StarGate Server runs on Windows NT 4.0 and, unlike the V/IP gateway, can extract data from Novell Directory Services (NDS), which Moore describes as "the best directory available today—bar none." StarGate Server is the only VoIP gateway available today that integrates with NDS. (However, Lucent Technologies plans to integrate its IP ExchangeComm System with NDS soon.) Like the V/IP gateway, StarGate Server connects to both your company's intranet and to the PBX or key telephone system.

If your company does not have an intranet, you might opt to purchase a gateway solution from a VoIP service provider, such as IDT. IDT offers companies a relatively new service called *Project David,* which enables you to route voice, data, and video traffic between branch offices over IDT's managed IP network. To subscribe to Project David, you must first purchase and install IDT's proprietary VoIP gateways, which include hardware and Unix-based software. IDT manages these gateways 24 hours a day, seven days a week. You must also lease lines to IDT's IP network from each of the branch offices where you install an IDT gateway.

Voices Carry—But How?

Gateway solutions vary widely in terms of how each is implemented, how each works, and what each offers. However, the following example gives you a general idea of how a VoIP gateway solution works:

Suppose that you implement a VoIP gateway solution on your company's intranet, which connects the corporate headquarters located in Iowa to branch offices located in several other states and countries, including Japan. (See Figure 1 on p. 8.) This solution enables phone-to-phone, PC-to-phone, and PC-to-PC VoIP communications between any user, anywhere on your intranet. You also install a VoIP gateway at each branch office and attach each of these VoIP gateways to both the intranet and the PBX or key telephone system in each office.

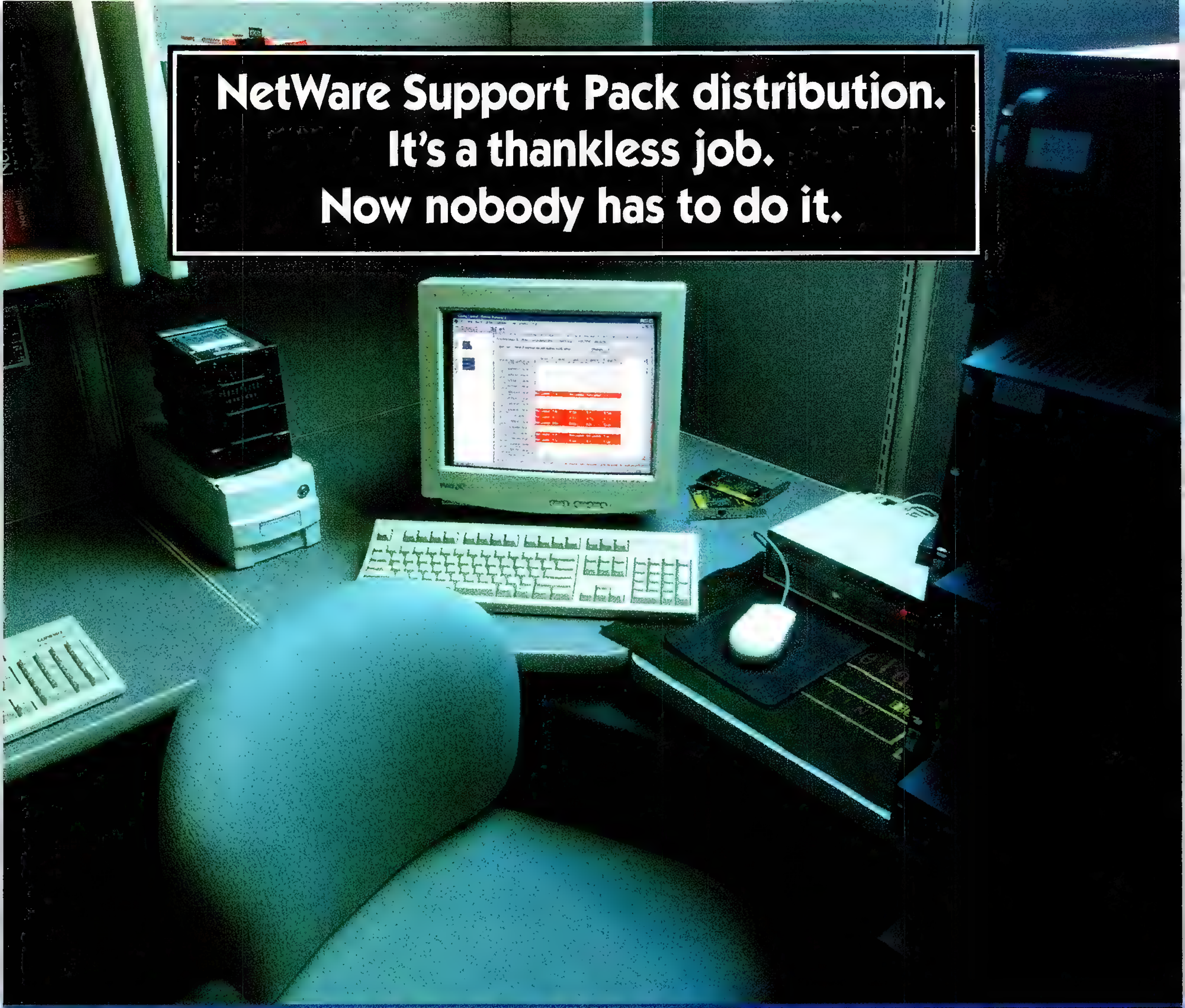
Now suppose that Joe Schmoe in Iowa wants to call Lee Schmee in Japan. To do so, Joe simply picks up his phone and dials a number, such as a 6 or an 8, indicating that this call should be routed through the local VoIP gateway. (Dialing the extra digit shouldn't strike Joe—or you—as odd. You probably use or have used a PBX system that requires you to dial a 9 or some other digit before dialing an outside line.) Upon hearing a second dial tone, Joe then dials Lee's number.

The PBX in the Iowa office intercepts Joe's call and forwards this call to the VoIP gateway, which is also in the Iowa office. Next, the Iowa VoIP gateway finds the IP address of the remote VoIP gateway that is associated with Lee's telephone number. In this case, the remote VoIP gateway is the gateway at the branch office in Japan. The two gateways then establish a connection, Joe hears the line ringing, and (for the sake of this discussion) Lee answers.

This telephone call will (or at least should) seem perfectly ordinary to both Joe and to Lee. From Joe's perspective, he dialed, the phone rang, and Lee answered. From Lee's perspective, the phone rang, she answered, and she and Joe started talking. Neither Joe nor Lee are aware—or even care—about the following facts of their phone call:

- For each word Joe and Lee spoke, each of the VoIP gateways making this call possible used a codec (which stands for voice coder/decoder) to convert the analog signal their voices generated into digital signals.
- The VoIP gateways also used codecs to compress the digital voice signals and break them into UDP/IP packets. (For information on why VoIP applications use UDP rather than TCP, see "UDP: The Choice for Voice" on p. 14.)
- Joe's and Lee's voices were transmitted over their company's intranet, which Joe and Lee also used to view and discuss a shared document during their conversation.
- Because the call was routed over the company's intranet, the call was essentially free. (For more information about the cost and potential savings of VoIP gateway solutions, see the "Sounds Like Money In The Bank" section on p. 17 in the main article.)
- Upon receiving packetized voice signals, each VoIP gateway used a codec to reconvert these digital signals into analog form before sending them to the locally attached PBX.
- During Joe's and Lee's conversation, the VoIP gateways sent between 20 and 40 voice packets per second. (Lucent Technologies estimates that during a typical phone conversation, a gateway sends 20 to 40 voice packets per second. See "Impact and Performance of Lucent's ITS over IP Networks," p. 2.)

Neither Joe nor Lee would know or care about any of these details because the call would sound just like a call routed over the PSTN. More specifically, any differences between the sound of the VoIP call and a traditional call would be imperceptible—at least, that's what VoIP gateway vendors and service providers claim.



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UDP: The Choice for Voice

Like all packets on an IP network, voice over IP (VoIP) packets have either TCP/IP or UDP/IP headers, depending on which protocol is being used to transport the packets over the IP network. Whether VoIP packets use UDP or TCP as the transport protocol depends in part on whether the signals these packets are carrying are voice or fax signals.

- For fax signals, VoIP gateways append either TCP/IP or UDP/IP headers to the packets that carry those signals.
- For voice signals, VoIP gateways append only UDP/IP headers to the packets that carry those signals.

According to a Nortel Networks white paper titled "Voice/Fax Over IP," UDP is the protocol of choice for transporting voice over IP for several reasons, including the following. (You can download this paper from http://www.micom.com/WhitePapers/index.html.)

- Unlike TCP, UDP doesn't require that the sending and receiving devices do any handshaking. The handshaking that TCP requires causes unnecessary delay, which can affect voice quality. UDP requires no such handshaking and, therefore, causes less delay. (See "Voice/Fax Over IP," p. 16.)
- Unlike TCP, UDP doesn't retransmit data when it detects an error. When TCP detects corrupted packets, it retransmits those packets. Retransmitting voice packets delays the delivery of those packets and can negatively affect voice quality.

  With UDP, a corrupted packet is usually thrown out, and the last good packet simply replayed. Listeners seldom notice packet replay if replayed packets comprise less than 5 percent of the packets transmitted during a given session. (See "Voice/Fax Over IP," p. 16.) On private networks, packets are seldom corrupted and, therefore, replaying packets is seldom necessary. ●

Keep Your Ears Open

Of course, not everyone accepts these claims. For example, *NetWare Connection* asked Nolle what advice he would give network administrators who are considering the purchase of a VoIP gateway. In response, Nolle warned that network administrators better make sure that everyone in their company "is aware of the impact that [a VoIP gateway] will have on the quality of speech and on the performance of the data network." Nolle added that network administrators "better be sure that [their] savings will be accrued very quickly to pay off the cost" of the gateway.

Nolle's implication is clear and stands in stark contrast to claims of VoIP equipment vendors and service providers: VoIP gateways, Nolle believes, negatively impact voice quality, consume a lot of bandwidth, and cost a lot of money. Although Nolle's implication is arguable, his advice is not. Both VoIP equipment vendors and service providers would agree with Nolle: When you check out a VoIP solution, you should look for a solution that offers good voice quality, low-bandwidth consumption, and enticing cost savings.

In fact, VoIP equipment vendors and service providers believe that these evaluation criteria are essential to the success not only of particular VoIP solutions but also of the VoIP industry in general.

THAT VOICE (OVER IP) SHOULD HAVE A FAMILIAR QUALITY

Unlike residential users, who are willing to settle for poor voice quality if they can finagle a free long-distance phone call over the Internet, corporate users won't trade quality for cost savings. If you implement a VoIP solution to carry voice over your company's intranet and the voice quality isn't precisely what users are accustomed to hearing, you might be the only one using that nifty solution (you and a few corporate devotees in accounting). The bottom line is that corporate users demand good voice quality—that is, voice that sounds like the voice they're used to hearing over the PSTN.

Unfortunately, IP networks have a few quirks that are tolerable when transporting data but can become annoying or, worse, intolerable when transporting voice. For example, packet delay and jitter are common on IP networks.

Packet delay refers to the average length of time it takes a packet to traverse an IP network. Delays occur on IP networks for several reasons. For example, delays occur because there are limits to how fast signals can be propagated over physical links and because network devices, including codecs and routers, have to process these signals, and processing takes time.

Network congestion also contributes to packet delay: Signals queue up to await processing at the routers they encounter during their journey through the IP network. The more congested the network, the longer the queue.

Variable delays, such as those associated with queues and processing, cause packets to arrive at different times, an effect called *jitter*. Jitter can negatively impact voice quality. In fact, if voice packets that comprise a conversation reach a codec at dramatically different times and the codec forwards these packets to the listener in the order they arrive, jitter could turn a conversation into gibberish.

When a network transports data, packet delay and jitter are no big deal. But these seemingly harmless quirks can negatively affect the quality of voice on an IP network. In fact, many industry analysts, equipment vendors, and service providers suggest that the Internet's long delays and high jitter are to blame for its inability to satisfactorily carry corporate voice traffic.

In marketing materials, VoIP equipment vendors and service providers state or imply that they can compensate for effects such as jitter, claiming that they provide the voice quality companies demand. For example, IDT claims that its Project David services provide "toll-quality transmission." Likewise, StarVox reports that the voice quality StarGate Server delivers is "indistinguishable from that of conventional PSTN telephone calls." Similarly, Nortel Networks' Tyre says that delay and jitter "are easy problems to overcome." Tyre adds that Nortel Networks has "been offering what we consider business-quality voice for the last couple of years with our V/IP product."

These claims are justifiable. VoIP equipment vendors and service providers can counter the impact of jitter on voice by using a jitter buffer. A jitter buffer is part of a VoIP gateway's memory. Gateways hold voice packets in their jitter buffers for a specified length of time before playing these voice packets (that is, before forwarding them to the listener). Holding voice packets enables the gateway

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Off The Record: Off-Net Calling

If you purchase and install a voice over IP (VoIP) gateway solution from an equipment vendor, calls between company offices will be free. However, calls to your partners and customers, who are not on your company's intranet, will not be free. These calls will go over the Public Switched Telephone Network (PSTN) and, consequently, accrue whatever costs your company's long-distance carrier is charging—unless you engage in a little off-net calling.

Off-net calling enables you to use your gateways to avoid some of the charges you would otherwise have to pay a long-distance carrier for calls outside your company's intranet. Off-net calling works like this: Suppose you have a VoIP gateway at corporate headquarters in Iowa and a gateway and PBX at a remote site in Japan. Now suppose you want to call a partner, who is is located in Japan and is not on your company's intranet. To avoid some of the costs you would otherwise incur by calling this partner directly, you could dial 6 for the local gateway, then dial the number for the remote gateway, then dial 9 for the PBX in Japan.

The next dial tone you heard in Iowa would be the dial tone of the PSTN in Japan. You could then dial the number of your partner in Japan, and the call would be a local call (or, at least, not an international call). A PBX that you use to sneak around charges for international, long-distance calls is called a "leaky PBX." A leaky PBX, according to Nortel Networks, is tolerated by phone companies and legal "in most countries." ("Voice/Fax Over IP," p. 26–27. You can download Nortel Networks' white paper in .pdf format from http://www.micom.com/WhitePapers/index.html.) ●

to begin playing these voice packets only when it can produce a steady stream of speech. In short, Tyre says, jitter buffers offer "plenty of opportunity to play voice back in a naturally smooth fashion."

That Codec Moment

Despite such optimistic claims, some people remain skeptical about the voice quality VoIP technologies can deliver. For example, to VoIP cynics like Nolle, the quality of voice carried over an IP network is just not the same as the voice you're accustomed to hearing with PSTN. "VoIP is immediately discernibly different than voice over the traditional PSTN," Nolle argues, boldly adding that "anybody who says otherwise is lying to you."

Nolle believes the cause of this ostensible degradation in voice quality, at least in part, is voice compression. Without voice compression, VoIP would be nearly impossible. After all, uncompressed voice consumes 64 kbit/s. To minimize the amount of bandwidth VoIP would otherwise consume, codecs compress voice. Unfortunately, compressing and decompressing voice require codec processing time. Processing time contributes to delays on the network, and delays can affect voice quality. Thus, ironically, the voice compression technology that makes VoIP possible also potentially degrades voice quality.

However, the codecs that compress voice are also designed to maintain an acceptable voice quality. In fact, standards for codecs include provisions for balancing voice compression and voice quality. During the past several years, the International Telecommunications Union (ITU) has developed seven standards for codecs: G.711, G.722, G.726, G.727, G.728, G.729, and G.723.1. (The ITU is a body within the United Nations Economic, Scientific, and Cultural Organization, more commonly known as UNESCO. You can find more information about ITU at http://www.itu.int.)

VoIP gateways commonly use the G.729 standard or the G.723.1 standard. For example, Nortel Networks' V/IP gateway uses a G.729 codec, and StarVox's StarGate Server uses a G.723.1 codec.

Although G.729 and G.723.1 offer different compression rates, they both purportedly deliver the same voice quality. More specifically, G.729 compresses voice to only 8 kbit/s. G.723.1 offers an even lower bit rate of between 5.3 and 6.3 kbit/s. Despite these low bit rates, Daniel Minoli, who has researched voice over data networks for more than 20 years, claims that both standards provide "good" voice quality. (See Daniel Minoli and Emma Minoli, *Delivering Voice Over IP Networks*, New York: John Wiley & Sons Inc., 1998, p. 155.)

THE SOUND OF SILENCE? CONSERVING BANDWIDTH

In addition to voice compression, the best bandwidth-reducing technology is *silence compression* (sometimes called *silence suppression*). Some codecs use silence compression algorithms to detect silences in voice conversations (or fax transmissions). These codecs conserve bandwidth by not sending packets at all during periods of silence. The codecs that IDT, Nortel Networks, and StarVox use in their VoIP gateways (Project David gateways, the V/IP gateway, and StarGate Server, respectively) all support silence compression.

As reported by Nortel Networks in a white paper titled "Voice/Fax Over IP," silence constitutes approximately 60 percent of a typical telephone conversation. (You can download this white paper in .pdf format from http://www.micom.com/WhitePapers/index.html.) Hence, silence compression can reduce voice packet bandwidth consumption by as much as 60 percent. (See p. 34.)

Nortel Networks estimates that because of the voice and silence compression technologies its G.729 codec uses, the V/IP gateway reduces the bandwidth voice packets consume to as few as 4 kbit/s. (See Figure 2 on p. 12.) Nortel Networks adds that, over a 20- to 30-minute period, a remote-site VoIP gateway trunk is active less than 25 percent of the time. Thus, the net average WAN bandwidth consumption per VoIP gateway trunk over a 20- to 30-minute period is about .25 x 4 kbit/s, or 1 kbit/s. One kbit/s is only approximately 1.7 percent of a 56/64 kbit/s link. (See "Voice/Fax Over IP," p. 36.)

Despite saving a sizable chunk of bandwidth, silence compression does have a few potential drawbacks. For example, if the silence compression algorithm doesn't immediately recognize an increase in audio energy, one or more of the first words uttered after a silence might get clipped off. However, advanced silence compression algorithms don't have this problem.

Another potential problem is that when no packets are being sent, you hear an eerie silence—the type of silence that prompts you to ask "Are you there?" Sophisticated silence compression algorithms avoid this dead-line effect by inserting comfort noise, or white noise, that lets you know the other party didn't hang up on you. StarVox's StarGate Server inserts this type of comfort noise during periods of silence.

More sophisticated silence compression algorithms include the ability to sample background noise and regenerate that noise during periods of silence. Nortel Networks' V/IP gateway and the gateways IDT uses for its Project David services both use background noise regeneration algorithms.

SOUNDS LIKE MONEY IN THE BANK

Because of concerns about voice quality and concerns about bandwidth, you may wonder why a company would bother with VoIP. Ask a VoIP equipment vendor, service provider, or industry analyst what attracts companies to VoIP, and you'll get the same answer: "What's driving [companies] to [VoIP] now is the potential to save money," says StarVox's Moore. In his September 1, 1998 "Pulver Points on the Internet Telephony Industry," Pulver says that VoIP "is all about cheap minutes. This is not hype," Pulver says, "but fact." (You can view these and other editions of "Pulver Points" online at http://www.pulver.com/points/index.html.)

Discussing the cost and potential savings of any technology is difficult. However, a few examples might help you form a general idea about how cheap VoIP minutes really are. Suppose your company purchases a provider's VoIP services, such as IDT's Project David services. Your company's initial investment will include the cost of the gateways for each office and the cost of the connections from these offices to IDT's IP network. Hofstetter says that the cost of each gateway depends upon its size and complexity. For example, a one-port, simple gateway costs about U.S. $200, whereas a 32-port fully integrated, sophisticated gateway costs about U.S. $40,000.

The cost of each connection from your company's offices to IDT's network depends on the type of connection your company needs, from a 56 kbit/s line to a T1 connection. Thus, the cost of each connection could range anywhere from U.S. $500 to $1,000 per month.

Once your company's gateways and connections are in place, your company starts saving. Although IDT will charge your company for each call made over its IP network, these charges will probably be considerably less than your company is paying now. For example, for its Project David services, IDT charges only 3 cents per minute for domestic calls and as few as 9 cents per minute for international calls.

The initial cost of a gateway solution that you purchase from a VoIP equipment vendor is probably going to be more than the initial cost of a gateway solution from a VoIP service provider. However, after you purchase and install a gateway from an equipment vendor, intracompany phone calls are free. (Your company must still pay for calls to persons outside of its intranet. To see how you can save on these calls as well, see "Off The Record: Off-Net Calling" on p. 16.)

For example, Nortel Networks has created a sample cost-savings scenario based on a 35-site network with V/IP Phone/Fax IP Gateway servicing 24 T1 digital channels at headquarters and one V/IP Phone/Fax IP Gateway at each site servicing an analog dual-channel. The initial cost for this solution is U.S. $76,720. Nortel Networks estimates that this company would spend about U.S. $554,400 in voice and fax charges, based on 10-cents per minute charges over five years. Given this estimate and the immediate, hard-cost savings of toll-free, intracompany calls, the V/IP gateway could save this particular company U.S. $477,680 within five years. This company could expect to recover the cost of its initial investment in the V/IP gateway within 8 months. (To view the estimated cost savings per month, visit http://www.nwconnection.com.)

StarVox provides free, online estimates on the number of months it would take for you to recover the undisclosed costs of StarGate Server and the estimated dollar amount you would save yearly by using StarGate Server. To get an estimate, complete StarVox's cost-savings worksheet, which is posted on StarVox's web site at http://www.starvox.com. Click the Network Telephony Theater selection from the Menu, and choose Start Saving Now from the list that appears.

StarVox bases its cost-savings estimates on variables such as the number of corporate users, the number of connected sites, the percentage of users that are domestic, and the cost per minute your company pays now for long-distance domestic and international calls. For example, the default answers to the worksheet questions show that a company with 20 sites and

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Equipment Vendor or Services Provider	Telephone Number
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IDT http://www.idt.com	1-201-928-2990 1-800-345-7015 U.S. and Canada
IDT's Click2Talk Division http://www.click2talk.com	1-201-907-5369 1-888-872-1230 U.S. and Canada
Lucent Technologies http://www.lucent.com	1-317-322-6848 1-888-584-6366 U.S. and Canada
Nortel Networks http://www.micom.com	1-805-583-8600 1-800-642-6687 U.S. and Canada
PSINet http://www.psi.ca	1-416-228-3400
Qwest Communications International Inc. http://www.qwest.net	1-800-860-2255 U.S. and Canada
StarVox Inc. http://www.starvox.com	1-408-383-9900

5,000 corporate users, 90 percent of whom are domestic, could expect to recover the cost of the initial investment in StarGate Server within 6.65 months. (This example assumes that the company was paying U.S. 8 cents per minute for domestic long-distance calls and U.S. 50 cents per minute for international long-distance calls before implementing StarGate Server.)

StarVox also suggests that the yearly savings for such a company would be U.S. $1,873,267.20. If that amount strikes you as inordinately high, it's because StarVox bases dollar savings not just on the hard-cost savings associated with bypassing tolls incurred on the PSTN but also on savings associated with "soft costs," such as gains in user productivity.

For example, StarVox estimates StarGate Server can save users who make about 40 calls per day an estimated .33 hours per day, which adds up to 66 hours saved per user, per year. If the average hourly salary of those users is U.S. $27 and there are 1,000 users, the savings per year equals approximately U.S. $1,777 per user, or $1,776,720 total in productivity gains for the year. (For more information about how StarVox estimates the cost savings associated with gains in user productivity, visit http://www.nwconnection.com.)

Are these estimates legitimate? After all, how can a VoIP gateway help users be more productive? In fact, most VoIP gateways don't. But StarGate Server offers more features than most VoIP gateways. According to StarVox, StarGate Server is not simply a VoIP gateway: StarGate Server is a network telephony server. With a network telephony server, Moore explains, you get more than just free phone calls.

Moore describes other VoIP gateways as "dumb pipes" because they leave behind many features corporate users expect. "With conventional telephony," Moore points out, users could "transfer a call, conference a call, or do call forwarding." Yet most VoIP gateways don't offer such conveniences. StarGate Server provides these PBX features. (For more information about StarGate Server, see "NDS-Enabled Applications: What Do They Have That Other Applications Don't," *NetWare Connection*, Aug. 1998, pp. 12–14. You can download this article from http://www.nwconnection.com/aug.98/nds.)

IN THE MARKET FOR A NEW SOUND SYSTEM?

Are you interested in VoIP yet? Predictions regarding the increase in VoIP-related revenue suggest that even if you aren't interested now, you will be interested within the next two to five years. For example, according to Frost & Sullivan, as reported by Delta Three, revenues for the VoIP gateway market are expected to increase at a compound annual growth rate of 229 percent, reaching U.S. $1.81 billion by the end of 2001. (See "The Market for Internet Telephony.")

Pulver estimates that VoIP equipment sales alone will exceed two billion dollars by 2001. By 2003, Pulver predicts, "20% of all voice traffic around the world will be IP-based."

IDT's predictions are more optimistic than Pulver's. According to Hofstetter, IDT believes that within the next two to three years, IP networks will carry not only voice but also data, cable, and video traffic.

Even cynics like Nolle admit that "five years from now, there will probably be a reasonable market for VoIP services." Nolle, like many others (including Pulver), believes the VoIP market will develop as an adjunct to the Virtual Private Network (VPN) market.

Despite these predictions, any rumors you might have heard about the PBX being dead or about IP-based networks killing the PSTN have been greatly exaggerated. The PBX and PSTN are not dead now nor will they ever be. In fact, in an August 4, 1998 press release, Forrester Research Inc. concludes "that the dream of a single network infrastructure for corporate voice and data will never be fully realized." (You can download this press release from http://www.forrester.com/Press/Releases/Standard/0,1184,29,00.html.)

Although it seems probable that there will always be separate voice and data networks, it seems equally probable that placing voice and data traffic onto one IP-based network will become increasingly common. The August 1998 press release from Forrester Research reports that of the Fortune 1000 corporations Forrester interviewed, "more than 50% expect to migrate some voice traffic onto their data network within two years."

Which raises a new question: When will you migrate some voice traffic onto your company's IP network?

Linda Boyer Kennard works for Niche Associates, which is located in Sandy, UT.

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NetWare 4.2

Expanding Your Choices

Linda Boyer Kennard

In September 1998, Novell released NetWare 5, which expectant reporters and Novell customers met favorably. (You can download articles and reviews about NetWare 5 from http://www.novell.com/netware5/press.html.) Only three months after the well-received NetWare 5 release, Novell released NetWare 4.2 to replace and enhance NetWare 4.11 and intraNetWare. The release of NetWare 4.2 might strike you as odd. After all, why would Novell continue to enhance its NetWare 4 product line when NetWare 5 is on the shelves and is, according to Novell, the best operating system available today for directory-enabled networking and high-level Internet integration?

The answer to that question is simple and relates directly to Novell's understanding of its customers' needs. Novell has a history of remaining loyal to its customers, as its continued support for NetWare 3 customers illustrates. Nearly five years ago, Novell made a radical shift from the server-centric paradigm characteristic of NetWare 3 to the network-centric, directory-enabled paradigm that sets NetWare 4 and now NetWare 5 apart. Novell encouraged, but did not force, its customers to make the same shift.

In fact, rather than force its customers to abandon their current investments in favor of a new operating system, Novell continues to offer and improve its NetWare 3 product line. Novell released the most recent enhancement, NetWare 3.2, just one year ago in January 1998. By continuing to offer and improve upon an existing product line when a new product line is available, Novell enables its customers to choose the operating system that best suits their needs and to upgrade at a manageable pace.

Like NetWare 3.2, NetWare 4.2 demonstrates Novell's commitment to customers who are not ready to upgrade to NetWare 5 immediately. "Novell believes that NetWare 5 provides the benefits customers want," says Novell's NetWare 4.2 product marketing manager, Sean Sanders, "and we recommend that they look at NetWare 5 as the best option for realizing the value of directory-enabled networking coupled with the highest level of Internet-enabled integration in a server operating system. However, we also realize that many Novell customers have valid business issues that prevent them from upgrading and implementing NetWare 5 in their environment today."

Generally, companies upgrade their network infrastructure every two to five years and want to be able to manage the rate of change in their environment. For example, many customers want to preserve their existing network investments in hardware, software, and training and cannot afford to upgrade their networks every time a new solution is made available. Some companies prefer to upgrade their network in phases. Novell's awareness of these customers' needs "prompted us to put together the NetWare 4.2 offering," Sanders explains. To help companies evaluate NetWare 5, however, a three-user version of NetWare 5 is included in the NetWare 4.2 box. (For more information, see "NetWare 5 or NetWare 4.2—Which Is Best for Your Company?" on p. 22 and "Comparing NetWare 5 and NetWare 4.2" on p. 24.)

DIFFERENT STROKES FOR DIFFERENT FOLKS

In other words, Novell is well aware that you all have different needs. The release of NetWare 4.2 illustrates Novell's commitment to meeting those needs. "NetWare 4 has and will continue to be an important part of the network solution on which many of our customers depend," says Novell's senior vice president of corporate marketing, John Slitz, in a December 7 press release.

Basically, NetWare 4.2 is intraNetWare with several additional features, including the following:

- NetWare 4.11 updates
- Zero Effort Networks (Z.E.N.works) Starter Pack 1.1
- Oracle8 for NetWare (five-user version)
- Netscape FastTrack Server for NetWare
- Novell Upgrade Wizard

These enhancements, coupled with a NetWare 4 and Novell Directory Services (NDS) foundation, enable NetWare 4.2 to offer Internet-enabled companies a means of managing their increasingly complex networks more effectively. NetWare 4.2 also lowers the total cost of owning a network.

Patches, Fixes, and Optional Year-2000 Updates

As you know, Novell makes any updates to its products available through Novell's Support Connection World-Wide

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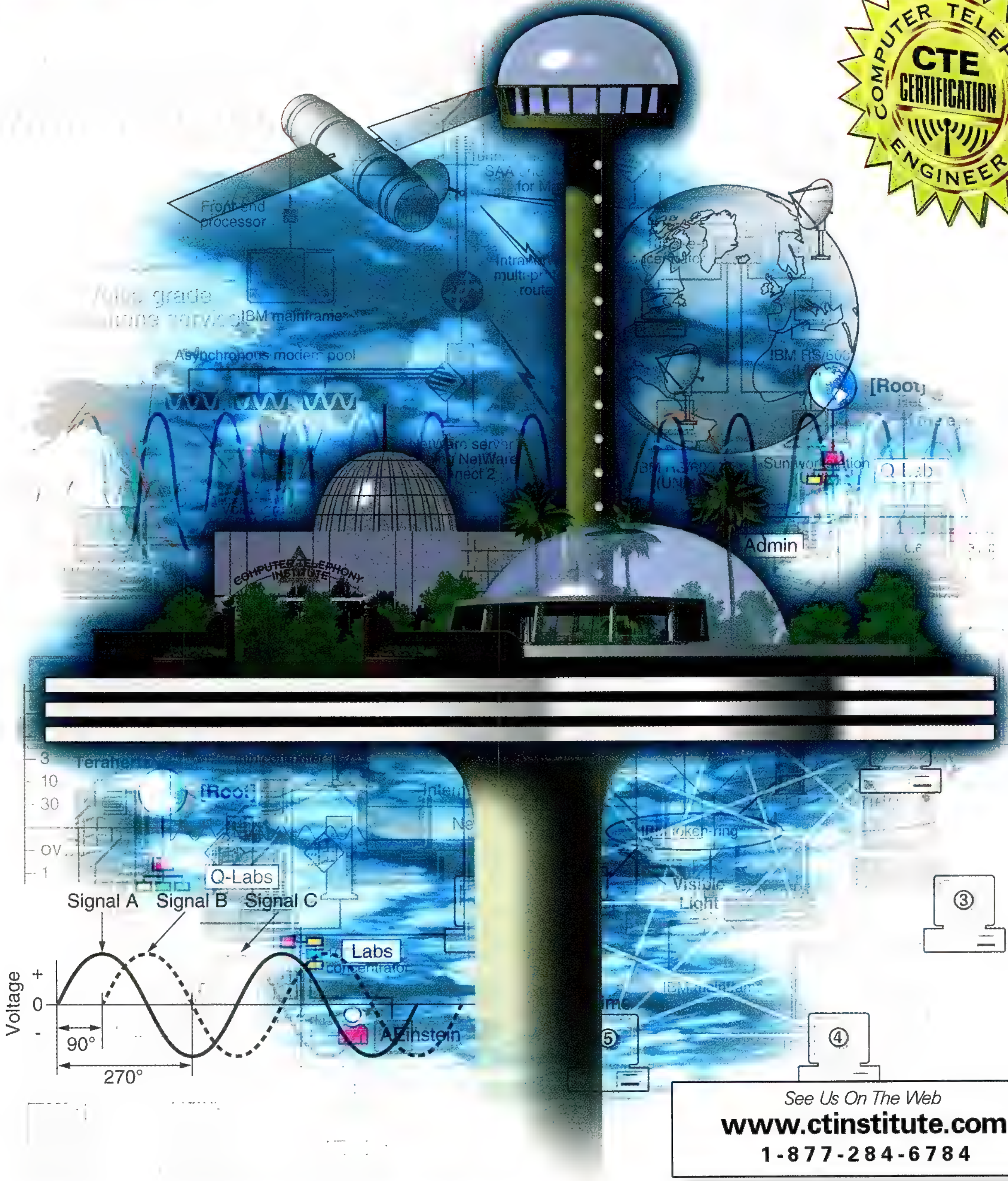

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NetWare 5 or NetWare 4.2—Which Is Best for Your Company?

Many NetWare 3.x, NetWare 4.x, or intraNetWare customers will upgrade directly to NetWare 5—but not all of them. Novell is aware that many of its customers have valid business reasons that prevent them from upgrading immediately to NetWare 5 and, in the interest of these customers, has upgraded its NetWare 4 product line. The following are four of the many valid reasons your company might want to upgrade to NetWare 4.2 now and before upgrading to NetWare 5 later.

- The disk capacity, memory, and performance limitations of your company's current server hardware preclude the possibility of running NetWare 5, and you want to extend the life of your hardware investment. The server hardware requirements for NetWare 4.2 are as follows: 386-based PC or above, 16 MB of RAM minimum, 100 MB hard disk recommended, and 55 MB of free hard disk space minimum. The server hardware requirements for NetWare 5 are as follows:
    - Pentium-based PC or above
    - 64 MB of RAM minimum
    - 1 GB hard disk recommended
    - 550 MB of free hard disk space minimum
- Your company's budget is limited, and the suggested retail price for NetWare 4.2 is approximately 10 percent less than NetWare 5. The suggested retail price for a five-user version of NetWare 4.2 is U.S. $1,095 compared with $1,195 for a five-user version of NetWare 5.
- You rely on several applications that run on NetWare 4.2 but are not yet certified on NetWare 5.
- You use Novell's SFT III, which NetWare 4.2 supports but NetWare 5 does not. (Novell will provide similar functionality in NetWare 5 through its high-availability products.)

Of course, other valid business reasons exist for preferring a NetWare 4.2 to a NetWare 5 upgrade. For example, when asked why he might recommend a NetWare 4.2 upgrade over a NetWare 5 upgrade, reseller Steven Krivit explained that he has "a lot of customers who depend on NetWare's reliability and are extremely conservative about changes." Krivit, who works for Data Link Services Inc. of Pacific Palisades, California, adds that these customers "don't want to change anything that's working well, particularly their NetWare 4.11 servers." Upgrading to NetWare 4.2, Krivit concludes, is an excellent choice for such customers "because it keeps them current with the operating system, without requiring them to significantly rework that operating system." ●

Web site (http://support.novell.com). Although these updates are free of charge and the service is valuable, it's probably safe to assume that few of you regularly check, install, and apply the updates posted on this web site. Because most of you are pressed for time, you probably take a more reactive approach to updates: That is, you wait until you (or users) encounter a problem, and only then do you check the Support Connection web site to see if an update is available to fix that problem. By upgrading to NetWare 4.2, you take a proactive approach to updates: With NetWare 4.2, you install the updates before you encounter the problems.

NetWare 4.2 includes Support Pack 6 for NetWare 4.11, which promises to significantly decrease the number of problems you encounter and, therefore, the number of updates you have to find, download, and apply. Support Pack 6 contains a comprehensive set of the NetWare 4.11 reliability updates that were available as of November 13, 1998, when Novell compiled Support Pack 6. This Support Pack contains updates for all of the services and utilities in NetWare 4.11, including updates for the operating system itself, NDS, the NetWare Administrator (NWADMIN) utility, and LAN drivers. Novell has tested all of the updates contained in Support Pack 6.

When you install NetWare 4.2, the installation program automatically installs and applies all of the updates included in Support Pack 6—including year-2000 updates. These updates address year-2000 glitches in NetWare 4.11 that do not pose a threat to network operations or to data integrity. In fact, NetWare 4.11 is year-2000 ready right out of the box. Nevertheless, Novell made available optional updates to the year-2000 glitches in NetWare 4.11. These updates, according to John Canfield, Novell's year-2000 marketing manager, address superficial, date display issues.

For example, in Japanese- and European-language versions of NetWare 4.11, the date format is appropriately displayed year/month/day. The format, of course, is not the problem. The problem is that without the update, only one digit is displayed for the year (for example, 0/01/25 for January 25, 2000). Although this single-digit year obviously does not impact the performance of the server, most people find the format disconcerting.

NetWare 4.2 corrects this problem through Support Pack 6, which includes updates that ensure the server displays two digits for the year (for example, 00/01/25). By upgrading to NetWare 4.2, you can ensure that when the year 2000 arrives, your network software will not only handle all date situations correctly but will also display those dates in an appropriate format.

Z.E.N.works Starter Pack 1.1

NetWare 4.2 (just as its NetWare 4 predecessors) offers a lower cost of network ownership than NetWare 3 or Windows NT. This lower cost of network ownership is a direct result of NDS. NetWare 4.2 is inextricably integrated with NDS, which allows you to store information about all network components. You can then access that information and manage these components from any workstation on the network. (Of course, you must have rights to manage these network components, and you must be able to access an NDS management utility, such as the NWADMIN utility, from that workstation.)

The NDS network-centric, directory-enabled approach to networking can save you time and, therefore, money. For example, through NDS, NetWare 4 servers reduce the time you spend managing user accounts. On an NDS-enabled network, such as NetWare 4.2, you create only one user account per user, regardless of the total number of servers and other network resources to which each user has rights. With NetWare 3, in contrast, you have to create a user account on each server a user needs to access.

NetWare 4.2 includes the latest version of NDS (version 6) and also includes an NDS application, which promises to reduce the cost of network ownership even more: Z.E.N.works Starter Pack 1.1. This Starter Pack is also included in NetWare 5 and dramatically simplifies desktop management. Z.E.N.works Starter Pack 1.1 is a subset of the fully functional Z.E.N.works product. This Starter Pack offers the functionality of Novell Workstation Manager 1.1 and includes the application management and distribution software formerly called Novell Application Launcher (NAL) 2.5.

The fully functional Z.E.N.works product, which you can purchase separately and use with NetWare 4.2, includes additional features such as a hardware inventory tool, remote-control software, and help desk policies. For more information about Z.E.N.works, visit Novell's web site at http://www.novell.com/nds.

Z.E.N.works Starter Pack 1.1 uses NDS to enable you to distribute, configure, update, and manage applications on workstation desktops from your own workstation or from any location on the network. Consequently, you will have to visit users' workstations on far fewer occasions. In fact, Novell speculates that Z.E.N.works' workstation management features, which are included in Z.E.N.works Starter Pack 1.1, can eliminate as many as 80 percent of your visits to users' workstations. Network administrator Oswald Seerattan of Electronic Data Systems believes that Z.E.N.works' workstation management features potentially cut the time he spends managing his network by 50 percent just because those features let him "administer desktops through NDS."

As with the fully functional Z.E.N.works, with Z.E.N.works Starter Pack 1.1 and NDS, you use the NWADMIN utility to create Application objects in the NDS tree. You then assign users or groups rights to these objects in the same way you assign rights to other NDS objects. Users at workstations running the Z.E.N.works client software (which is included in the Z.E.N.works Starter Pack 1.1) then double-click the Z.E.N.works Application Launcher icon to view a list of all of the applications they have rights to access.

Because the applications you deliver through Z.E.N.works Starter Pack 1.1 are linked to a user's NDS login ID rather than stored on a specific, physical workstation hard drive, users can access the applications they need from any workstation on the network. As a result, all users, including remote users, can reach the tools they need to stay productive.

Z.E.N.works and NDS are helping to usher in a new era of location independence for the desktop and the PC user.

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Create and manage *any* new NDS attributes (e.g. social security number, user photo). Easily create NWADMIN snapins without programming! Includes a graphical schema viewer and schema extension wizard.

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Comparing NetWare 5 and NetWare 4.2

FEATURES	NETWARE 5	NETWARE 4.2
Management		
Novell Directory Services (NDS)	Yes	Yes
WAN traffic manager	Yes	No
Catalog services	Yes	No
LDAP 3 support	Yes	No
Role-based management	Yes	No
DNS/DHCP integrated with NDS	Yes	No
Z.E.N.works Starter Pack	Yes	Yes
NetWare Management Agents (NMA)	Yes	No
ConsoleOne (Java-based management console)	Yes	No
Internet/Intranet		
IP support	Pure IP	IP via NetWare/IP (encapsulation)
Compatibility mode	Yes	N/A
Migration agent	Yes	Yes *(provides integration with NetWare 5)*
Netscape FastTrack Server	Yes	Yes
IPX/IP gateway	No	Yes
Multiprotocol WAN router	Yes	Yes
FTP services	Yes	Yes
Kernel		
Symmetrical multiprocessing (SMP)	Yes *(single kernel supporting up to 32 processors)*	Yes *(separate multiprocessing NLM supporting up to 8 processors)*
Memory protection	Yes	No
Virtual memory	Yes	No
Application prioritization capabilities	Yes	No
Core Services		
Novell Storage Services (NSS)	Yes	No
Novell Distributed Print Services (NDPS)	Yes	Free add-on
I20 support	Yes	Yes, with free file download
Secure Authentication Services (SAS)	Yes	No
Public Key Infrastructure (PKI)	Yes	No
Application Development		
Java Virtual Machine (JVM) and Java tools	Yes	Add-on
Common Object-Request Broker Architecture (CORBA)	Yes	No
NetBasic interpreter	Yes	Yes
JavaBeans	Yes	No
JavaScript	Yes	No
Visual Basic scripting support	Yes	No
PERL 5.1	Yes	Yes
Integrated debugger	Yes	Yes
Novell International Cryptographic Services	Yes	No
Oracle8	Five-user version	Five-user version
Upgrade Support		
REXXware Migration Toolkit (RMT)	Free download available	Free download available
Novell Upgrade Wizard	Yes (for upgrades from NetWare 3 & NetWare 4)	Yes (for upgrades from NetWare 3)
Other		
Year-2000 ready	Yes	Yes
Remote access via NetWare Connect	Yes	Yes
Recommended server hardware requirements	Pentium or higher processor, 64 MB of RAM, and 550 MB of available disk space	386 or higher processor, 16 MB of RAM, and 105 MB of available disk space

They deliver what Novell chairman and CEO Eric Schmidt calls a "digital persona" for each user. The digital persona refers to a concept of a network that remembers who you are and what network resources you need. Z.E.N.works and NDS make such a concept possible by enabling you to create a unique desktop configuration for each user.

This desktop configuration is based on each user's needs, rather than on his or her physical location. In other words, a user doesn't have to sit at the same workstation every day to get the same desktop configuration. Regardless of the user's location, when the user logs in to NDS, the user will see the desktop uniquely configured to suit his or her needs. For example, when a user logs in, the user will see all of the applications to which he or she has rights. (For more information about Z.E.N.works, see "NDS and Z.E.N.works," *NetWare Connection*, October 1998, pp. 24–33. You can download this article from http://www.nwconnection.com/oct.98/zen08.)

Oracle8 for NetWare

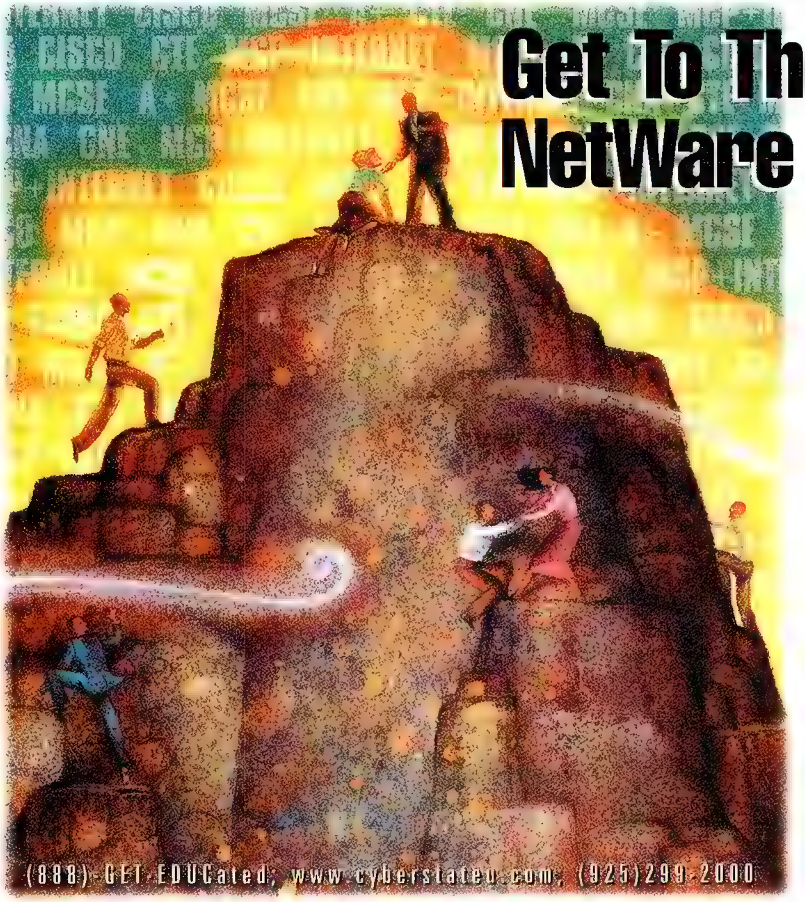
If you opt not to store data on users' workstations, you obviously need to store data elsewhere. Conveniently, NetWare 4.2 includes an alternative application and data storage solution: Oracle8 for NetWare. Like NetWare 5, NetWare 4.2 includes a five-user version of Oracle8 for NetWare in the box. (Oracle8 for NetWare is still available for NetWare 4.11 and intraNetWare customers. You can order Oracle8 for NetWare from the Novell web site at http://www.novell.com/intranetware/oracleorder.html or from the Novell Customer Response Center at 1-888-321-4272 or 1-801-228-4272. Novell charges a small fee to cover postage and handling.)

Oracle8 is a relational database that enables you to store more applications and more data than you will ever need. You will also be able to deliver these applications and that data reliably and securely to more users than your company will probably ever have.

Specifically, the Oracle8 database stores up to several petabytes of data and supports as many as 50,000 concurrent users. Just as a point of reference, one petabyte is 1,024 terabytes, and you would need only 10 terabytes to store the entire printed collection of the U.S. Library of Congress.

Oracle8 for NetWare is fully integrated with NDS, enabling you to manage the database just as you manage all other network resources from any workstation on the network. Because Oracle8 is integrated with NDS, you don't have to be familiar with Oracle8 to control users' access to it: You can control users' access to Oracle8 using the NWADMIN utility.

The integration between Oracle8 and NDS provides several other features, including a single login. When users with rights to the Oracle8 database log in to the network, NetWare 4.2 automatically authenticates these users to Oracle8 based on their authentication to the NDS tree. As a



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Is your network the means or the end?

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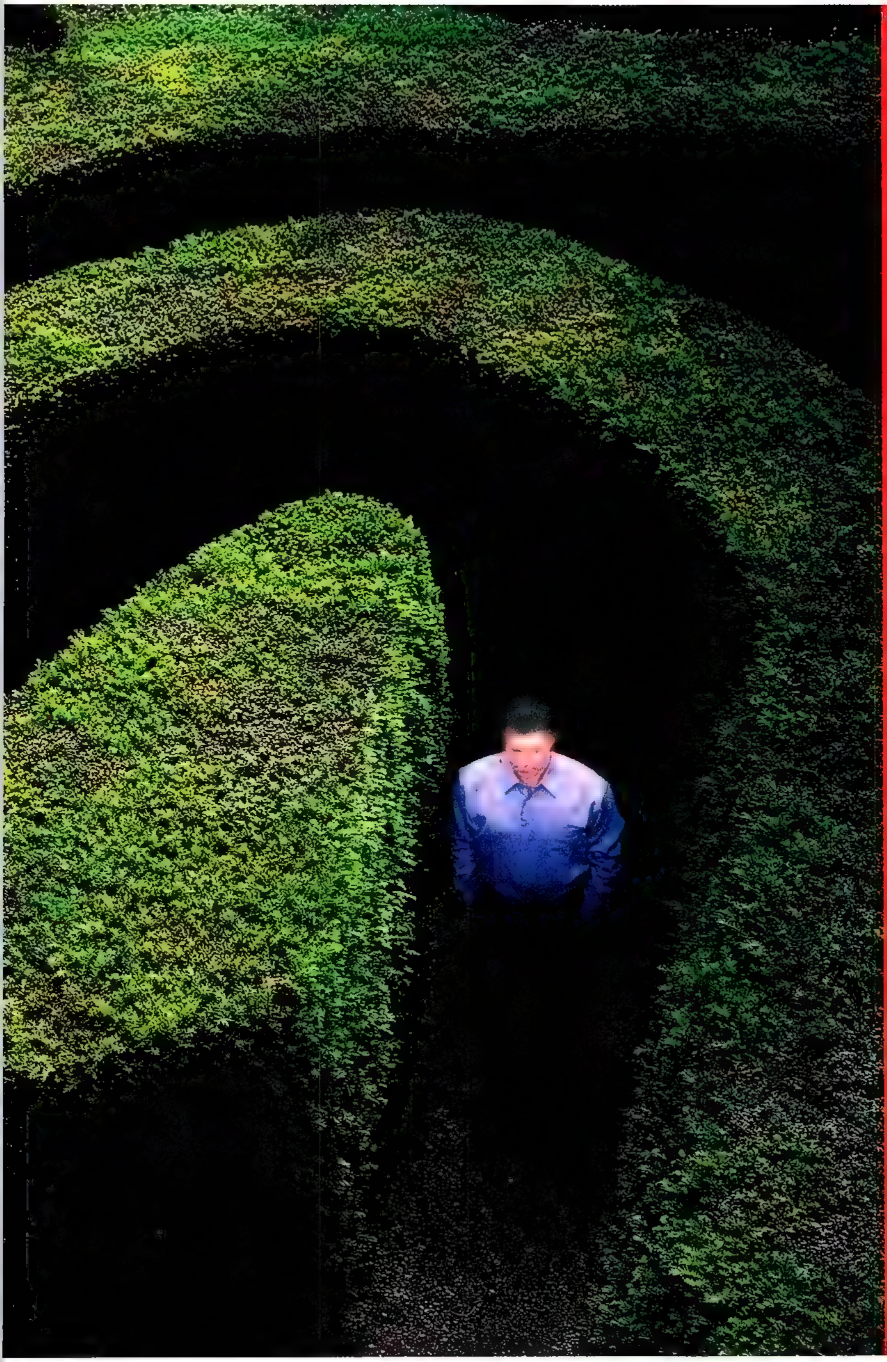

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Both.

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. and other countries.

result, users are spared the inconvenience of having to enter a separate username and password to access the Oracle8 database.

Netscape FastTrack Server for NetWare

If your company is like most companies, it probably either has a web site or would like to have one. If lack of time is preventing you from getting your company on the Internet, NetWare 4.2 can help. NetWare 4.2 includes the Netscape FastTrack Server for NetWare.

Winner of the *Datamation* 1997 product of the year award, FastTrack Server is easy-to-use software for creating, publishing, and serving web documents. FastTrack Server enables individuals and workgroups—even the web illiterate—to create personal web sites from their own workstations and to publish web documents quickly and easily. You realize the implications of this, don't you? Through FastTrack Server, NetWare 4.2 enables your users to do for themselves what you might otherwise have to do for them.

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- PERSONNEL SCHEDULING
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To enable users to browse the web, NetWare 4.2 includes Netscape Communicator. Netscape Communicator is a browser, e-mail, and calendar suite that includes Netscape Navigator 4, the latest version of Netscape's popular web browser. (NetWare 4.11 and intraNetWare shipped with Netscape Navigator 2.01.)

Upgrading to NetWare 4.2

NetWare 4.2 also includes the Novell Upgrade Wizard, which can help reduce the costs associated with upgrading your operating system. Also included in NetWare 5, the Novell Upgrade Wizard, is a graphical modeling and upgrade tool that simplifies the process of migrating a NetWare 3 server across the wire to a new or existing NetWare 4.11, NetWare 4.2, or NetWare 5 server. (For more information about the Novell Upgrade Wizard, see "Novell Upgrade Wizard: Upgrading Couldn't Get Easier," *NetWare Connection*, Aug. 1998, pp. 30–35. You can download this article from http://www.nwconnection.com/aug.98/wizard.)

The Novell Upgrade Wizard performs three processes: modeling, verification, and migration. During the modeling process, you create an upgrade project, which enables you to model the NetWare 3 bindery and file system offline before you actually migrate this information. During the upgrade project, you use the modeling screen, which displays the source NetWare 3 bindery and volume information on the left and the NDS tree on the right. You can then select existing NDS Organization or Organizational Unit (OU) objects in which you want the NetWare 3 bindery information to reside, or you can create a new OU object.

This modeling process is performed in an offline database, which means that the NDS objects you create during this process will not be created in the actual NDS tree until you select Novell Upgrade Wizard's Migrate option. As a result, you can try several modeling scenarios until you find the one best-suited for your company.

After you decide where the NetWare 3 bindery and volumes belong in your NDS tree and before you select the Migrate option, you should use the verification process. During the verification process, Novell Upgrade Wizard notifies you of problems that may affect a successful migration, such as naming conflicts between bindery objects being migrated and existing NDS objects. By default, the Novell Upgrade Wizard automatically verifies name spaces, rights, and NLM versions and notifies you if a problem exists. You can also specify that you want the Novell Upgrade Wizard to check for and notify you of duplicate objects and insufficient disk space.

Once you verify that no problems exist, you select the Novell Upgrade Wizard's Migrate option. During the ensuing migration process, the Novell Upgrade Wizard copies Bindery and Volume objects from the NetWare 3 server, converts these objects to NDS objects, and places the NDS objects in an existing NDS tree according to the model you created during the upgrade project.

If you are simply upgrading from a NetWare 4.11 or intraNetWare server to NetWare 4.2, you won't need to use the Novell Upgrade Wizard. In this case, you simply select the upgrade option in the NetWare 4.2 INSTALL utility.

IT'S GETTING BETTER ALL THE TIME

As you may have noticed, Z.E.N.-works Starter Pack 1.1, Oracle8 for NetWare, Netscape FastTrack Server, and the Novell Upgrade Wizard are existing products. So what's the big deal about NetWare 4.2? The big deal is that NetWare 4.2 conveniently includes all of these products and enhancements in the box. Although the NetWare 4.2 features are not new, they bring NetWare 4 servers up-to-date and make those servers better.

NetWare 4.2 includes more features than those that have been explicitly mentioned here. For example, NetWare 4.2 includes NetWare Connect 2, which enables remote users of Windows, Macintosh, and DOS systems to dial in to a NetWare 4.2 network to access network information and resources such as files. databases, applications, e-mail, printing, and host/mainframe services. In addition, NetWare 4.2, unlike NetWare 4.11, includes online documentation, so you can find answers to your questions more easily—and faster.

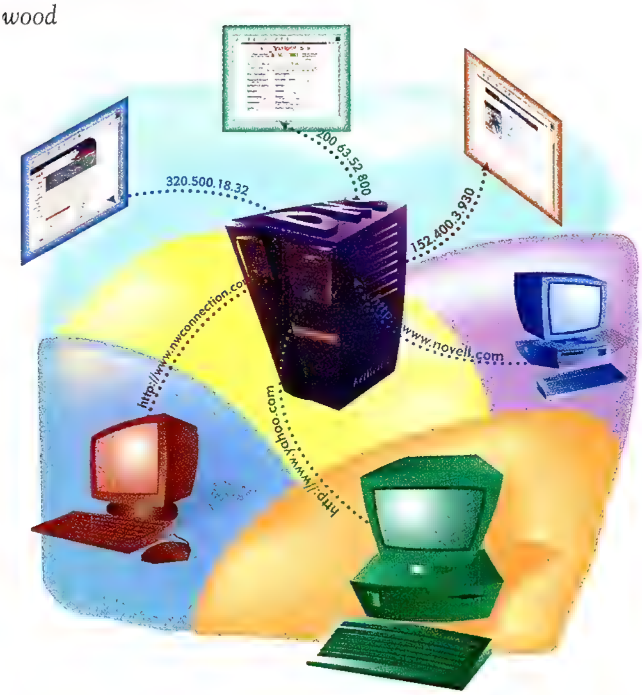
Linda Boyer Kennard is a frequent contributor to NetWare Connection. *She works for Niche Associates, an agency that specializes in writing and editing technical documents.* ●

NOVELL CERTIFIED PROFESSIONAL

Drew Heywood

NDS and DNS

Configuring DNS Services in NetWare 5



As a NetWare administrator, you may wonder why TCP/IP needs Domain Naming System (DNS), which makes it possible to call computers by name instead of by their numbers. After all, IPX does not require a labor-intensive naming service. On an IPX network, you simply configure a server, and names just happen.

Unfortunately, the protocols that make IPX networks so easy to manage, Service Advertising Protocol (SAP) and Routing Information Protocol (RIP), were designed with LANs in mind. Confined to a LAN, the chatty natures of SAP and RIP don't have a major impact on performance. If you use SAP and RIP on a limited-bandwidth WAN, however, you begin to begrudge the existence of every unnecessary packet.

TCP/IP, on the other hand, was designed with large WANs in mind. Chatty protocols were out of the question. As a result, DNS is highly scalable and efficient. Unfortunately, DNS is not especially easy to manage. (You may also have heard of Service Location Protocol, or SLP, which is new to NetWare 5. SLP provides a low-bandwidth, automated naming service for TCP/IP networks. SLP is a new protocol, however, and is far from supplanting DNS for the majority of TCP/IP services.)

NetWare 5 includes DNS and Dynamic Host Configuration Protocol (DHCP) services that integrate neatly with the NetWare environment. These services store their data in Novell Directory Services (NDS). NDS integration gives the DNS and DHCP services some unique advantages.

Because DNS and DHCP are not self-configuring, you must set up these services from the ground up. Although the configuration procedures aren't particularly difficult, they do require that you thoroughly understand the services. This article is the first in a series of articles that explains how to set up and manage the DNS and DHCP services in NetWare 5. This article focuses on DNS: It explains DNS basics and then describes how to set up DNS on a NetWare 5 server. (In this article, I assume you are familiar with IP addressing. If you need information about IP addressing, see "Choosing IP Addresses for Your Network," *NetWare Connection*, Feb. 1997, pp. 20–26. You can download this article from http://www.nwconnection.com/feb.97/ipadd27.)

Illustration: Jessica Chen

WHY DOES TCP/IP NEED DNS?

As you know, networks don't use computer names to deliver data. When a packet is sent to a particular destination, the destination is identified by numbers. Every computer is identified by a combination of a network number and a computer number that must be unique throughout the network. The following example shows how addresses and server names are associated on an IPX network.

Suppose a computer named FOO wants to send a message to a computer named PHU. Does FOO stuff the name PHU in a packet and send it? No, using the name won't work. FOO has to learn the network number and the computer number of PHU. On an IPX network, FOO issues SAP or NDS queries to obtain this information. (FOO may also need to send a RIP query to learn the address of a router that can reach PHU.) Once FOO has the required addresses and routing information, FOO can stuff a packet with the addresses and send it to PHU. The process of using a computer's name to learn its numeric addresses is called *name resolution*.

A similar process occurs on TCP/IP networks, but TCP/IP networks provide a special service specifically to support name resolution. Computers that need to determine the IP address of a host send a name resolution request to DNS. (Network devices on a TCP/IP network are typically called *hosts*.)

THE ARCHITECTURE OF DNS

DNS was designed to handle computer names on the Internet. The Internet's DNS database, referred to as the *DNS name space*, is probably the largest, most widely accessed database in the world. Thousands of new domain names are registered daily, and millions of DNS queries originate hourly from every point on the planet.

For all of that size and activity, DNS must be easy to use, responsive, robust, and manageable. The design of DNS reflects these demanding requirements. To illustrate how DNS works, the following sections describe some characteristics of DNS.

The DNS Name Space Structure

The DNS name space is hierarchical. You should be familiar with at least two computer-based hierarchies: computer file systems

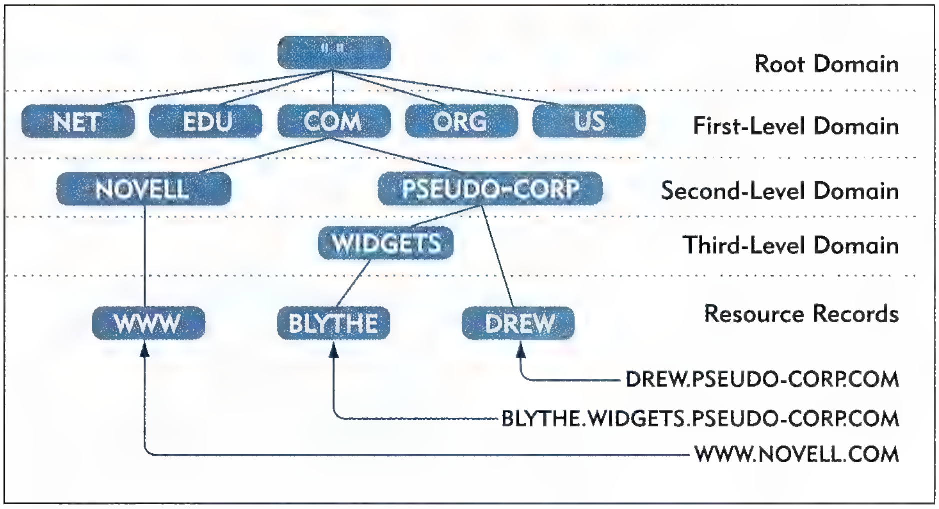


Figure 1. *The Internet's DNS name space is hierarchical.*

and NDS. Hierarchies are highly structured, making it easy to place data into categories. Hierarchies are also easy to extend, so there is maximum capacity to the DNS name space. (Hierarchies are often referred to as *trees*, reflecting their branch-like structures.)

The categories of the DNS hierarchy are called *domains*. Domains correspond to directories in file systems or to container objects in NDS. Figure 1 shows part of the Internet's domain hierarchy. As you can see, domains can contain other domains, just as directories can contain subdirectories.

You can refer to domains that contain other domains in several ways: You can call them *domains* and *subdomains*, or you can call them *parent domains* and *child domains*. There are no limits to the number of child domains that can be spawned by a parent domain. DNS is, at least in theory, infinitely extensible.

DNS domains are organized in levels. At the top of the DNS hierarchy is a single root domain, just as NDS has a single [Root] object. Below the root domain are top-level, or first-level, domains. For example, the Internet contains first-level domains such as COM, NET, EDU, ORG, MIL, and GOV. The Internet also contains first-level domain names for countries, each of which has a two-letter name such as US for United States and IT for Italy.

As you might expect, child domains of first-level domains are called *second-level domains*. For example, pseudo-corp.com is a second-level domain. Not surprisingly, child domains of second-level domains are called *third-level domains*—foo.pseudo-corp.com, for example. The list can go on, almost without limit although most DNS server implementations impose a maximum number of levels to the DNS hierarchy. Still, the maximum number of levels is very high, and you would almost never want to create DNS trees with as many levels as a DNS server can support.

A domain can also contain resource records, which store the actual DNS data. Resource records correspond to files in directories or to leaf objects in NDS. Resource records describe domain characteristics, the names of computers in the domain, or other domain-related data.

The most common resource record is the Address record, which maps a computer's DNS name to its IP address. For example, suppose you create an Address resource record in the pseudo-corp.com domain and this record specifies that the IP address of a computer named www is 192.168.35.80. When a user requests a connection to www.pseudo-corp.com, the user's browser queries DNS for the IP address of the requested computer. DNS locates the Address resource record and informs the user's browser that the IP address of www.pseudo-corp.com is 192.168.35.80, enabling the browser to establish a connection.

In NDS, an object's complete, or distinguished, name consists of the object name joined in order with the names of all the container objects between the object and the [Root] object. For example, an NDS object may have the distinguished name of .CN=CHARLY.OU=SALES.OU=CHICAGO.O=PSEUDOCORP, which can be expressed without the container designations as .CHARLY.SALES.CHICAGO.PSEUDOCORP.

Similarly, a computer's complete DNS name is the computer name (also called host name) joined in order with the names of all the domains between the computer's Address resource record and the root domain. For example, the host foo in the domain pseudo-corp.com has the complete DNS name of foo.pseudo-corp.com. This complete DNS name is the host's fully qualified domain name (often referred to as its FQDN).

Host names and domain names can consist of letters, hyphens, and the digits 0 to 9 and are not case sensitive. The period is restricted for use as the separator character. Other than the hyphen and period, you cannot use punctuation marks.

Delegation of Authority

Imagine what would happen if the designers of DNS had tried to store the entire Internet name space on one computer. How could one computer store all of that data and respond to the millions of name queries that are generated each hour by Internet users? Moreover, what sort of bureaucracy would be required if all host names on the Internet had to be tracked and updated at one central location? The designers of DNS knew that a decentralized, highly scalable architecture was required if DNS was to keep up with future growth.

DNS is scalable and manageable because it incorporates a distributed database. Parts of the Internet's DNS name space are stored on thousands of DNS servers located throughout the world. In theory, each domain can be serviced by its own DNS server. No matter how many DNS servers exist, however, DNS easily navigates these servers to resolve name queries quickly and efficiently.

A DNS server is responsible for the names in one or more zones. (A *zone* consists of one or more domains.) A DNS server is said to have authority for a zone or to be authoritative for a zone. Through a system of DNS server resource records, the numerous DNS servers coordinate their efforts to provide name services for the Internet's DNS name space.

The large number of DNS servers solves two problems of scale: First, name queries are distributed. Instead of relying on one supercomputer, the Internet relies on many, more modest computers, often no more than simple microcomputers that are authoritative for the subdomains and resource records of individual companies.

Second, DNS data are distributed across many DNS servers. As a result, management is distributed as well. For example, suppose you are the network administrator of Pseudo Corp, and you have registered the domain pseudo-corp.com. Also suppose that you operate a DNS server that is authoritative for pseudo-corp.com and stores the resource records in pseudo-corp.com.

If you need to update resource records, you make the changes at a local computer, just as thousands of DNS administrators may be doing at any given time. You do not have to submit a request to a central DNS administrator, who may schedule the request for service in a few days. Because DNS management is distributed, management even of the Internet is scalable.

If the Internet name space is distributed over thousands of DNS servers, each of which understands only a piece of the overall picture, how do all of the pieces fit back together? Upper-level DNS servers delegate authority to lower-level DNS servers. Examining a DNS query illustrates how this delegation of authority works.

Suppose that user Buster on computer buster.malaprop.com needs to access www.pseudo-corp.com. (See Figure 2.) To make a connection, Buster's browser needs to know the IP address of www.pseudo-corp.com, so the browser issues a DNS query. Because Buster's computer is configured to use dns1.malaprop.com, a local DNS server, Buster's browser directs a name query to dns1.malaprop.com.

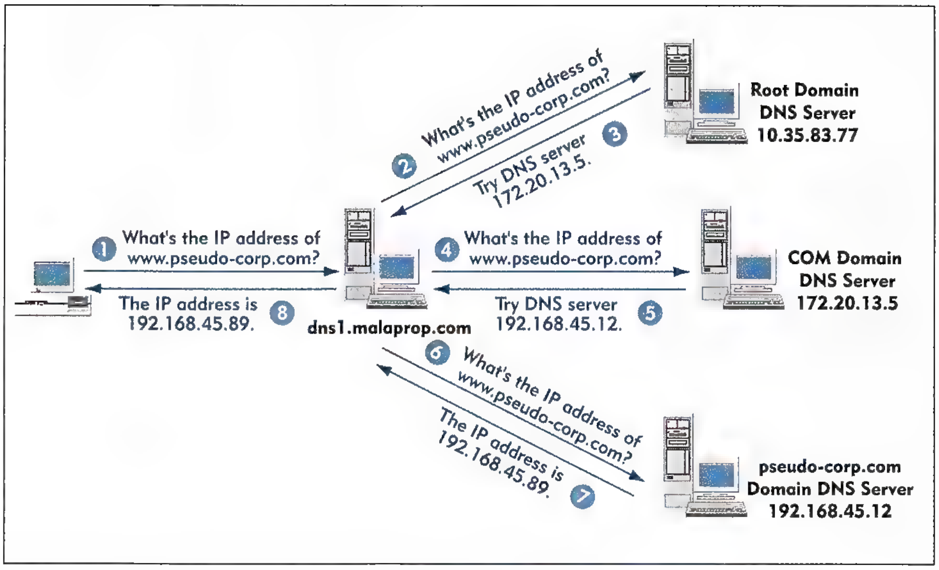

Root Domain
DNS Server
10.35.83.77
② What's the IP address of www.pseudo-corp.com?
③ Try DNS server 172.20.13.5.
① What's the IP address of www.pseudo-corp.com?
⑧ The IP address is 192.168.45.89.
dns1.malaprop.com
④ What's the IP address of www.pseudo-corp.com?
⑤ Try DNS server 192.168.45.12.
COM Domain
DNS Server
172.20.13.5
⑥ What's the IP address of www.pseudo-corp.com?
⑦ The IP address is 192.168.45.89.
pseudo-corp.com
Domain DNS Server
192.168.45.12

Figure 2. *If a DNS server cannot resolve a name query, this server sends the query to another DNS server that may be able to provide a response.*

In response to the query, dns1.malaprop.com must do one of two things: It must respond with the IP address of www.pseudo-corp.com, or it must return an error message stating that the host cannot be found. (DNS servers maintain a cache of recently resolved names. If dns1.malaprop.com has the IP address for www.pseudo-corp.com in cache, dns1.malaprop.com can respond to Buster's query immediately without querying other DNS servers.)

Suppose dns1.malaprop.com doesn't know the IP address of www.pseudo-corp.com and doesn't know how to contact a DNS server that is authoritative for pseudo-corp.com. Since dns1.malaprop.com cannot resolve the name, it must initiate a search for the name, starting from the root domain. Every DNS server knows the IP addresses of DNS servers that are authoritative for the root domain, so dns1.malaprop.com sends a query to one of these servers.

Unfortunately, the root DNS server isn't authoritative for pseudo-corp.com. However, the root DNS server can return the IP address of a DNS server that is authoritative for the first-level domain COM.

Next, dns1.malaprop.com contacts the DNS server that is authoritative for COM. Although this DNS server cannot respond to the name query, it knows the IP address of a DNS server that is authoritative for the second-level domain pseudo-corp.com and sends this IP address to dns1.malaprop.com. Finally,

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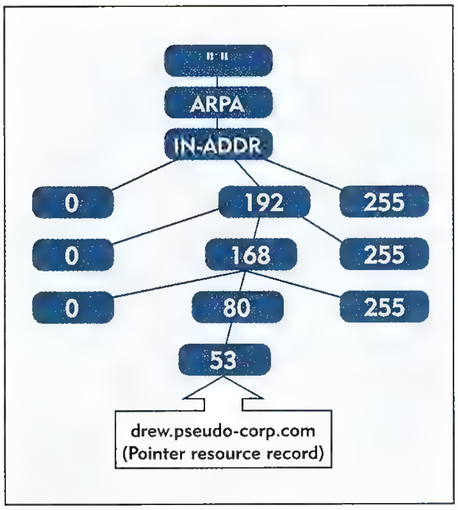


Figure 3. *The IN-ADDR.ARPA name space enables DNS to search for Pointer resource records that map an IP address to a particular host's fully qualified domain name.*

dns1.malaprop.com contacts a DNS server that can respond to the query.

The original query from Buster's browser was directed through four DNS servers before dns1.malaprop.com found a DNS server that could provide the correct IP address. Each DNS server knew only a piece of the overall name space, but all of the servers worked together to resolve the query one step at a time.

Forward and Reverse Naming

The DNS tree shown in Figure 1 is called a *forward-naming tree*. DNS servers use forward-naming trees to determine the IP address associated with a host name. (See p. 30.)

DNS also supports *reverse-naming* trees. DNS servers use reverse-naming trees to determine the host name associated with an IP address. Because some TCP/IP services depend on reverse naming, you should configure DNS servers to support both forward and reverse naming.

Figure 3 shows the part of the Internet's DNS name space that is used for reverse naming. The first- and second-level domains are named ARPA and IN-ADDR respectively. (Because of these domain names, the reverse-naming database is often referred to as the *IN-ADDR.ARPA name space*.) Below these domains, each domain is associated with an octet of the host IP addresses.

The following example shows how DNS conducts a reverse-naming lookup to identify the host name associated with the IP address 192.168.80.53.

The search really starts at the third level below the root domain, which contains 256 domains, one for each of the 256 values that are available for the first octet of an IP address. In this example, the DNS query locates domain 192, which corresponds to the first octet of IP address 192.168.80.53.

The search then proceeds to the fourth level, which also contains 256 domains. The DNS query locates domain 168, which corresponds to the second octet of IP address 192.168.80.53.

The search continues at the fifth level, which also contains 256 domains. The DNS query locates domain 80, which corresponds to the third octet of IP address 192.168.80.53. In domain 80, the DNS query finds a Pointer resource record that maps address 53 (the last octet of IP address 192.168.80.53) to host name drew.pseudo-corp.com.

As you can see, the DNS query uses reverse-naming to search down the IN-ADDR.ARPA name space for each successive octet in the requested IP address. With a Class C address (such as 192.168.80.53), the DNS query must search to the fifth level of the IN-ADDR.ARPA name space. A Class B address can be resolved at the fourth level, and a Class A address can be resolved at the third level.

REGISTERING A PRIVATE DNS SERVICE WITH THE INTERNET

To establish a presence on the Internet, your company needs to obtain a block of IP addresses and a domain name. Under current Internet policies, most companies obtain a block of IP addresses from their Internet service provider (ISP). Only large companies obtain IP addresses directly from the Internet address authority. (For more information about the Internet address authority, visit http://www.iana.org/ip-addresses.html.)

You must register your company's domain names through a central authority, thereby establishing the domain name in the Internet name hierarchy. After your domain is registered, the appropriate first-level DNS servers will be aware of the IP addresses for your company's DNS servers. These first-level DNS servers can then refer queries for your company's domain to your company's DNS servers.

If you want to register a domain name under the first-level domains COM, NET, ORG, and GOV, you use the InterNIC Registration Services, which are currently provided by Network Solutions Inc. You can find forms for registering and modifying domains names at http://www.internic.net.

If you want to register a domain name under another first-level domain, such as EDU or MIL, you must contact the appropriate central registration authority. To find the authorities for other first-level domains, visit http://www.iana.org, which is operated by the Internet Assigned Numbers Authority (IANA).

Because approximately 20,000 Internet domain names are registered each day, you may have to do a lot of research to identify a domain name that isn't in use. The primary research tool is WHOIS, which is available at http://www.internic.net.

After you identify the domain name that you would like to use, you should identify the IP addresses of at least two DNS servers that will have authority for this domain. When you apply for the domain name, you must supply the IP addresses of these DNS servers.

The DNS servers can be hosted by an ISP, or they can be located on your company's network. If an ISP hosts your company's domain, you must submit name changes to the ISP and wait for the ISP to process the request. ISPs typically update their domain databases overnight, so you may have to wait 24 hours before a change shows up in the online DNS database.

If your company operates its own DNS servers, name changes can be implemented more expeditiously. If you use the DNS services included in NetWare 5, name changes can be posted almost immediately.

You will receive an additional benefit if you use the NetWare 5 DHCP service to assign IP addresses to computers on your company's network. As the DHCP service updates IP address assignments, it can notify the DNS service of these changes so that new address resources records can be posted immediately in the DNS name space. This capability, called *Dynamic DNS* (DDNS), is available only if you use the DNS and DHCP services in NetWare 5.

Primary and Secondary DNS Servers

As mentioned earlier, when you register a domain, you must provide the IP addresses of at least two DNS servers. As far as the Internet is concerned, additional DNS servers provide fault tolerance. If the primary DNS server fails, secondary DNS servers can resolve names for the zone. Secondary servers can also offload some of the processing for their zone. Users can resolve a host name by sending a DNS query to any of the DNS servers that are authoritative for the requested host's domain.

With most DNS implementations (such as the Berkeley Internet Name Domain or BIND), you configure one primary DNS server and one or more secondary DNS servers for each zone. (BIND is the most popular type of DNS server on the Internet.) The primary DNS server stores the master copy of the zone database. If you need to make changes to the zone, you must make these changes on the primary DNS server.

Each secondary DNS server periodically performs a zone transfer: It copies the zone database from the primary DNS server or from another secondary server. The source DNS server for the zone transfer is called the *DNS master server*.

A TCP/IP client should be configured with the IP addresses of at least two DNS servers, enabling the client to find another DNS server if the first DNS server is unavailable. Secondary DNS servers retain a copy of the zone database both in memory and in a local database file. Secondary DNS servers can use their local database file if they need to restart while the primary DNS server is unavailable. If the primary DNS server is unavailable, however, no changes can be made to the zone database.

DNS AND NDS

Novell has added a twist to the traditional DNS architecture. In NetWare 5, DNS database entries are stored as NDS objects. As you know, NDS is a distributed database, making these database entries available to every server on the network. Because DNS database entries are stored in NDS, you do not have to set up a primary DNS server that stores the master copy of the zone database.

With the DNS service in NetWare 5 , all DNS servers act as primary DNS servers. To change the DNS database, you make changes to NDS objects, and these changes are immediately available to all DNS servers that are authoritative for a given zone.

There is one exception to this configuration, however. You may need to configure the NetWare 5 DNS servers to coexist in an environment that includes other types of DNS servers, such as BIND. If a BIND DNS server is the primary DNS server for a zone and you want NetWare 5 DNS servers to be authoritative for this zone, you must configure one NetWare 5 DNS server as a secondary DNS server for the zone. (See Figure 4.)

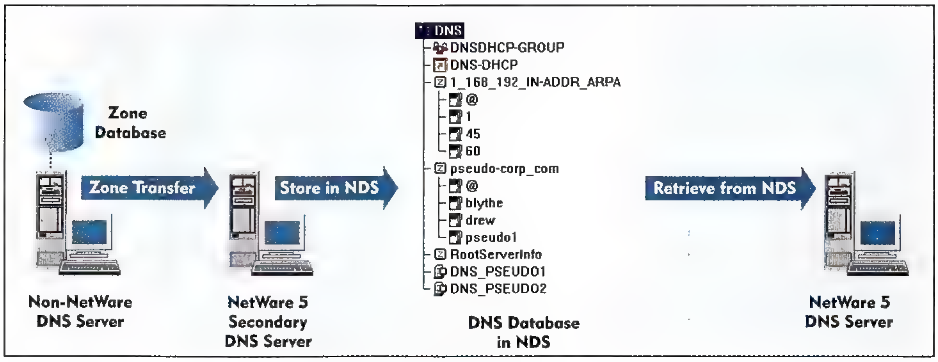


Figure 4. *You can configure a NetWare 5 DNS server as a secondary server if the zone's primary server is not a NetWare 5 server.*

The secondary NetWare 5 DNS server initiates zone transfers to obtain the zone data from the BIND DNS server. The NetWare 5 DNS server then populates NDS with the appropriate objects. If you have other NetWare 5 DNS servers in the same zone, they obtain the zone data from NDS.

NDS Objects for the DNS Service

Although DNS data are stored as NDS objects, you do not use Novell's NetWare Administrator (NWADMIN) utility to manage these objects. Instead you use the new DNS/DHCP Management Console (which is, incidentally, a Java-based console). As you manipulate DNS and DHCP objects in the DNS/DHCP Management Console, the console creates, modifies, and deletes the NDS objects as required.

DNS data are stored in the following objects, which the NetWare 5 DNS service adds to the NDS schema:

- **DNS Server Object.** You create a DNS Server object for each DNS server. A DNS server can be authoritative for one or more zones.
- **Zone Object.** You create a Zone object for each zone. A zone can contain one or more Resource Record Set objects that define the hosts in that zone.
- **Resource Record Set Object.** The DNS/DHCP Management console creates Resource Record Set (RRSet) objects as required to store the resource records you define. All resource records for a host are associated with the host's RRSet object.

Resource records are not stored as distinct NDS objects. Instead, resource records are stored as attributes of RRSet objects. Because resource records are not NDS objects, you can view them only in the DNS/DHCP Management Console.

Zone objects are container objects, and RRSet objects are always stored in Zone objects. However, DNS Server objects are leaf objects. The relationships between Zone objects and DNS Server objects are stored in the attributes of the Zone objects themselves, not in the NDS tree structure.

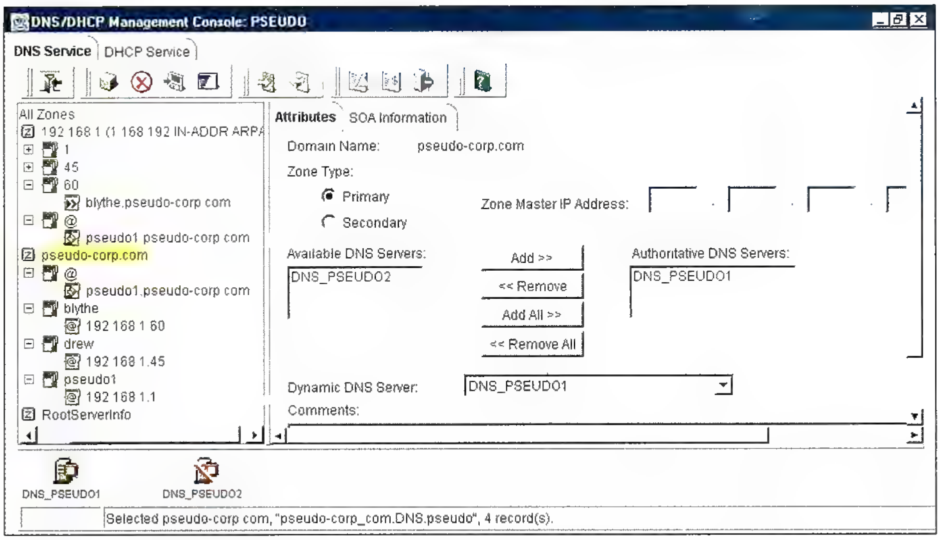
Extending the NDS Schema

Before you can do any work with the DNS or DHCP services, you must install these services on the NetWare 5 server and extend the NDS schema. The DNS and DHCP software components are automatically installed when you install NetWare 5. (This explains why the Novell DNS/DHCP services option shows a size of 0 MB in the INSTALL utility's Additional Products and Services screen.) You can extend the NDS schema during or after the NetWare 5 installation.

To extend the NDS schema during the installation of NetWare 5, you select the Novell DNS/DHCP Services option in the Additional Products and Services dialog box. If you select this option, the NDS schema extensions will be installed during the installation process. You will then see a dialog box that prompts you to specify the location where the DNS and DHCP objects should be placed.

However, because Novell recommends that you place the DNS and DHCP objects in their own container objects, I recommend that you don't extend the NDS schema during the NetWare 5 installation. Instead, you should complete the NetWare 5 installation, create the container objects that will hold the DNS and DHCP objects, and then extend the NDS schema.

After installing NetWare 5, you can add and remove the schema extensions by using the DNIPINST utility at the server console. To add the schema extensions to



Domain Name: pseudo-corp.com

Zone Type: ● Primary ○ Secondary

Zone Master IP Address:

Available DNS Servers: DNS_PSEUDO2

Authoritative DNS Servers: DNS_PSEUDO1

Dynamic DNS Server: DNS_PSEUDO1

Comments:

Selected pseudo-corp com, "pseudo-corp_com.DNS.pseudo", 4 record(s).

Figure 5. *You use the DNS/DHCP Management Console to manage the DNS and DHCP services in NetWare 5.*

NDS, you enter LOAD DNIPINST at the server console. To remove the extensions, you enter LOAD DNIPINST –R at the server console.

In addition to the schema extensions, several objects are added to NDS. You can place these objects anywhere in the NDS tree, but you should create container objects for DNS and DHCP objects so that you can restrict administrative access to the objects. You may want to create separate container objects for the DNS and DHCP services. You may even want to create multiple container objects for each service if you have more than one group of network administrators.

The following objects are created when you extend the NDS schema:

- **DNS/DHCP Locator Object.** This object contains global default values, DHCP options, lists of DNS and DHCP servers, DHCP subnets, and DNS zones. You can place this object in any container object. I suggest you place the DNS/DHCP Locator object in one of the container objects you created for DNS or DHCP objects.
- **DNS/DHCP Group Object.** DNS and DHCP objects use this object to gain rights to the DNS and DHCP data stored in NDS. When the DNS/DHCP Management Console creates DNS Server objects or DHCP Server objects, they become members of the DNS/DHCP Group object and are given the rights required to access data. Again, you can place the DNS/DHCP Group object in any container object. I recommend you place the DNS/DHCP Group object in the same container in which the DNS/DHCP Locator object resides.
- **RootSrvrInfo Zone Object.** This object contains a list of the DNS servers that have authority for the Internet's root domain, enabling your company's DNS servers to refer queries to DNS servers on the Internet. You should place the RootSrvrInfo Zone object in the container object that holds other DNS objects.

Note: As we go to press, NetWare 5 Service Pack 1 is in beta testing, and Novell expects to finalize this service pack soon. If you are running the NetWare 5 DNS service, Novell recommends that you install NetWare 5 Service Pack 1, which corrects some minor problems with the DNS service. Check Novell's Support Connection web site (http://www.support.novell.com) for NetWare 5 Service Pack 1.

The DNS/DHCP Management Console

After installing the DNS/DHCP services on a NetWare 5 server, you install the DNS/DHCP Management Console on a Windows NT, 98, or 95 workstation by executing the SETUP.EXE file. This file is located in the SYS:\PUBLIC\DNSDHCP directory on the server running the DNS and DHCP services.

The DNS/DHCP Management Console has two tabs, which you use to configure the DNS and the DHCP services. The screen for both services is divided into four areas. (See Figure 5.)

- A toolbar appears at the top of the screen. You initiate all operations from the toolbar; there are no menus. When you move the cursor over a toolbar button, a help balloon pops up, displaying the button's name.
- The left-hand pane displays the tree that contains all of the objects that have been defined for the service you selected. This tree also shows the hierarchical relationships among the objects.
- The right-hand pane displays detailed information about the object that is selected in the tree.
- At the bottom of the screen, an icon appears for each server that has been defined for the selected service. These icons show the status of the service, indicating whether it is running, stopped, or paused.

The rest of this article explains how to create and manage DNS objects. I recommend that you set up a test environment so you can try out the procedures and see how the objects are created and managed.

CREATING AND MANAGING DNS SERVER OBJECTS

The best way to start configuring your DNS server is to create a DNS Server object for each NetWare 5 server that will run the DNS service (NAMED.NLM). You should define at least two DNS Server objects to provide fault tolerance and offload processing.

You must have the Create right for the container object in which you want to create an NDS object. When creating most DNS objects, you can specify the container object in which the object will be created. DNS Server objects, however, are always created in the container object that holds the NetWare 5 Server object. After you create the DNS Server object, you can use the NWADMIN utility to move the DNS Server object to another container object.

You complete the following steps to create a DNS Server object:

1. Select the DNS tab in the DNS/DHCP Management Console.
2. Click the Create button in the toolbar. You click the Create button to create all types of DNS objects. To create some objects, you must select a parent object in the DNS tree before you click the Create button. For example, you must select a Zone object before you can create a resource record. However, you can create

a DNS Server object regardless of the object that is selected in the DNS tree.

3. After you click the Create button, a menu appears, listing the types of objects you can create. Select the DNS Server option.
4. The Create DNS Server dialog box appears, containing the following fields:

   - **Select Server Object.** In this field, specify the NetWare 5 server that will run the DNS service. Enter the full (distinguished) NDS name of the NetWare 5 server, or click the NDS Browse button to select a server from the NDS tree.
   - **Host Name.** In this field, enter the DNS host name for the server. This host name may or may not be the same as the server's NetWare name.
   - **Domain.** In this field, specify the DNS domain in which the DNS server resides. For a server with the DNS fully qualified domain name of pseudo1.pseudo-corp.com, you would enter pseudo-corp.com in this field.
   - **Define Additional Properties.** If this box is checked, the DNS/DHCP Management Console displays detailed information about the DNS Server object after it is created. You can then review or modify the properties of the object you created.

5. Click the Create button in the dialog box to create the DNS Server object.

After the DNS Server object is created, a server icon appears at the bottom of the DNS/DHCP Management Console screen. At first the server icon has a slash through it, indicating that the DNS server is either inactive or unable to communicate with the DNS/DHCP Management Console. (The process of activating the DNS server is explained later in this article.)

Figure 6 shows a DNS Server object and its detail parameters, which include the zones for which the DNS server has authority. (See p. 36.) You assign DNS servers to zones in the Zone object's detail parameters. You can't modify these assignments in the DNS Server object's detail parameters.

CREATING AND MANAGING PRIMARY ZONE OBJECTS

Each Zone object defines a DNS zone, which stores the DNS data for one or more domains. Typically, a separate zone is created for each domain, but child domains can be included in the zone that supports their parent domain. However, this article focuses on zones that are authoritative for one domain. This article also focuses on primary zones since secondary zones are required only if the primary DNS server for a domain is not a NetWare 5 DNS server.

Creating a Forward-Naming Zone Object

You must create a Zone object for each DNS zone that your DNS servers have authority for. You should first create a forward-naming Zone object by completing the following steps:

1. Select the DNS tab in the DNS/DHCP Management Console.
2. Click the Create button in the toolbar, and select Zone from the menu that appears.
3. The Create Zone dialog box appears, containing several fields. (See Figure 7 on p. 37.)

   - **Create New Zone.** Select this radio button to create a forward-naming zone. The fields you see in the Create Zone dialog box change, depending on the radio button you select.
   - **NDS Context.** In this field, specify the container object in which the Zone object will be created. You can also click the Browse button to select the container object from the NDS tree.
   - **Zone Domain Name.** In this field, enter the full DNS name for the domain that will be associated with this zone.
   - **Primary.** Select this radio button to create a primary zone.
   - **Assign Authoritative DNS Server.** If DNS Server objects have been created, you can select one in this field. You can specify additional DNS Server objects later. If you specify a DNS Server object that has been defined, the Host Name and Domain fields will be completed for you.
   - **Host Name.** In this field, you enter the DNS host name for the server. The host name may or may not be the same as the server's NetWare name.
   - **Domain.** In this field, you specify the DNS domain in which the DNS Server resides.
   - **Define Additional Properties.** If this box is checked, the DNS/DHCP Management Console displays detailed information about the DNS Server object after it is created. You can then review or modify the properties of the object you have created.

After the Zone object is created, its icon appears in the tree displayed in the left-hand pane of the DNS/DHCP Management Console screen. If you expand the Zone object, an RRSet object with the name @ appears. In DNS jargon, @ is shorthand for "this zone," so the @ RRSet object contains resource records that are associated with the domain for which you created the Zone object. The DNS/DHCP Management Console creates RRSet objects as needed to contain resource records.

Under the @ RRSet object is a Name Server resource record. As mentioned earlier, resource records are stored as attributes of RRSet objects.

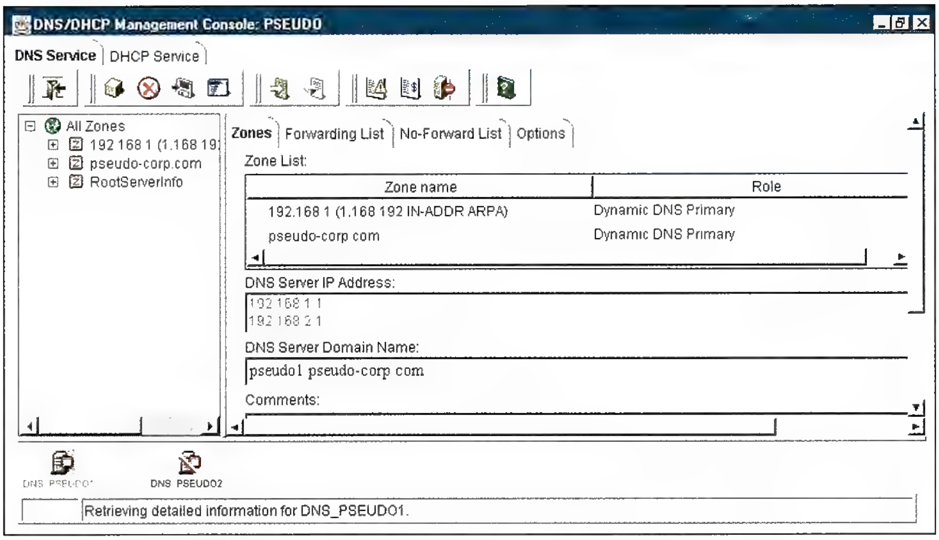
Creating a Primary Reverse-Naming Zone Object

Although reverse-naming isn't essential, some operations depend on it. For example, an application can use reverse-naming to learn a user's DNS name for authentication purposes. If possible, you should create an IN-ADDR.ARPA reverse-naming zone for each IP address range on your network. For example, if your company is assigned the Class C addresses 192.168.5.0 and 192.168.17.0, you should create two IN-ADDR.ARPA zones, one for each Class C address range.

You should be aware of a restriction that is derived from the way IN-ADDR.ARPA zones are configured. The domains in the IN-ADDR.ARPA name space don't include subnet address information and are always organized on even 8-bit IP address boundaries. This restriction does not affect you if your company has been assigned a class A, B, or C IP address range or if your company subnets a Class A or B address range on an even 8-bit boundary.

Increasingly, however, Internet addresses are assigned based on a system called *Classless Inter-Domain Routing* (CIDR). With CIDR, address ranges don't necessarily fall on 8-bit boundaries.

If your company's IP address range does not fall on 8-bit boundaries, your company cannot host its own IN-ADDR.ARPA zone. Instead, you must work with your company's ISP, which owns the entire address class that contains your address range. Your ISP can add your company's IP addresses to the IN-ADDR.ARPA zones on



Zone List:

Zone name	Role
192.168 1 (1.168 192 IN-ADDR ARPA)	Dynamic DNS Primary
pseudo-corp com	Dynamic DNS Primary

DNS Server IP Address:
192 168 1 1
192 168 2 1

DNS Server Domain Name:
pseudo1 pseudo-corp com

Comments:

Retrieving detailed information for DNS_PSEUDO1.

Figure 6. *The detail parameters for the DNS Server object show the zones for which the DNS server has authority.*

the ISP's DNS servers. Unfortunately, you will not be able to use NetWare 5's Dynamic DNS to update these IN-ADDR.ARPA zones. This is a limitation of the DNS technology at this time.

If your company's IP address range falls on an even 8-bit boundary, you can create an IN-ADDR.ARPA zone. Creating an IN-ADDR.ARPA zone is similar to creating a forward-naming zone, except that you select the Create IN-ADDR.ARPA radio button in the Create Zone dialog box, which changes to display fields used to define a reverse-naming zone.

One of the fields that change is the Zone Domain Name field. For an IN-ADDR.ARPA zone, you specify your company's IP address range. For example, you may enter the Class C address 192.168.5.0 as the zone name.

When you enter the IP address range, the DNS/DHCP Management Console constructs the actual Zone object name in the blank below the IP address fields. Like all domain names, the names of IN-ADDR.ARPA zones are constructed by starting with the lowest domain in the hierarchy and joining together all of the domain names between the lowest-level domain and the root domain.

For example, the IN-ADDR.ARPA zone for the IP network 192.168.5.0 is 5.168.192.IN-ADDR.ARPA. If you enter 192.168.5.0 in the IP address fields, the DNS/DHCP Management Console displays 5.168.192.IN-ADDR.ARPA in the blank space below the IP address fields. This name identifies the IN-ADDR.ARPA Zone object you are creating.

Managing Zone Objects

To manage a Zone object, you select the Zone object in the left-hand pane of the DNS/DHCP Management Console screen. The details pane displays two tabs: Attributes and SOA Information. The Attributes tab contains the following fields:

- **Zone Type.** This field has two radio buttons, Primary and Secondary, which enable you to change the zone type at any time. If you change the zone to a secondary zone, you must specify the IP address of a zone master server.
- **Available DNS Servers.** This field lists the DNS servers for which you have created DNS Server objects. None of these servers are authoritative for the zone. You can assign zone authority to a DNS server by selecting it from this list and clicking the Add button.
- **Authoritative DNS Servers.** This field lists DNS servers that are authoritative for the zone. You can revoke a DNS server's authority for the zone by selecting the DNS server in this list and clicking the Remove button.
- **Dynamic DNS Server.** If you have enabled Dynamic DNS, you must configure one of the DNS servers that is authoritative for the zone as the zone's Dynamic DNS server.
- **Comments.** Like many NDS objects, Zone objects have a Comments field in which you can add descriptive text. This field is a good place to record the Zone object's history.

The SOA Information tab for a Zone object contains Start of Authority (SOA) information, which includes some descriptive data for the zone and several operational parameters for the zone. On most DNS servers, SOA information is stored in an SOA resource record, but on a NetWare 5 DNS server, SOA information is stored as attributes of a Zone object. The SOA Information tab contains the following fields:

- **Zone Master.** This field is informational only and does not have any effect on the operation of the NetWare 5 DNS service. On other DNS systems, this field identifies the DNS name of the primary DNS server for a zone, but this distinction does not apply to NetWare 5 DNS servers. Simply specify the DNS name of one of your DNS servers, so that users who query the zone for its SOA records can receive this information.
- **E-mail Address.** This field should contain the e-mail address of a person who is the administrative contact for the domain. Because @ is a special character in DNS (meaning "this zone"), it cannot appear in the e-mail address. As a result, you would enter the e-mail address drew@pseudo-corp.com as drew.pseudo-corp.com.
- **Serial Number.** A serial number is maintained for the zone. The serial number actually consists of four fields: Year, Month, Date, and Revision Number. The serial number is automatically incremented each time zone data change. If the serial number is not incremented, DNS servers will not update themselves from the zone records in NDS.
- **Refresh.** This field specifies the interval in minutes at which a secondary DNS server checks its source DNS server to determine whether a zone transfer is required. The secondary DNS server uses the serial number to determine whether zone data have changed. The default refresh interval is 180 minutes. On a dynamic network, you may want to consider a shorter refresh interval such as 60 minutes.
- **Retry.** This field specifies the time in minutes that a secondary DNS server waits after a failed zone transfer before this server retries the zone transfer. The default retry interval is 60 minutes. If you shorten the refresh interval, you should

also shorten the retry interval. For example, if the refresh interval is 60 minutes, consider a retry interval of 20 minutes.

- **Expire.** This field determines the maximum number of hours that a secondary DNS server continues to retry a zone transfer. If the secondary DNS server can't perform a successful zone transfer before this time expires, this DNS server discards data for the zone. The default expiration interval is 168 hours.
- **Minimum TTL.** When a DNS server responds to a DNS query for data in its zone, the DNS server includes this value in the response. The Minimum TTL informs the recipient of the response the minimum time in hours that the data should be retained in the recipient's local DNS cache.

When you change an object's parameters, you must commit the changes to NDS. You can save the changes immediately by clicking the Save Data to NDS button in the toolbar, or you will be prompted to save your changes when you select another object in the DNS/DHCP Management Console screen.

CREATING AND MANAGING RESOURCE RECORDS

The rest of this article explains how to create and maintain three types of resource records. Each type of resource record has a conventional abbreviation, which you will want to recognize:

- Address (A) resource records map host names to IP addresses. There is an Address resource record for every host with a name that can be queried in DNS.
- Pointer (PTR) resource records map IP addresses to host names and appear in IN-ADDR.ARPA zones. If you implement IN-ADDR.ARPA zones, a Pointer resource record is created for each host identified in an Address resource record.
- Name Server (NS) resource records identify which computers function as DNS servers for a zone. A zone may have several Name Server resource records.

Creating Address Resource Records

The majority of the resource records that you create will be Address resource records. They are the primary reason DNS exists in the first place, for without them names cannot be resolved to addresses. NetWare 5 provides a streamlined process for creating an Address resource record:

1. Select the DNS tab in the DNS/DHCP Management Console's screen.
2. Select the Zone object under which you will create the Address resource record.
3. Click the Create button in the toolbar.
4. Select Resource Record in the Create New DNS Record menu.
5. The Create Resource Record dialog box appears. Because Address resource records are created so frequently, the A radio button is selected by default.
6. Enter the host's name in the Host Name field. By default, the Domain field contains the name of the domain that is associated with the zone. Ordinarily, you will not edit this field.
7. In the IP Address field, enter the IP address of the host.
8. Click Create.

After you create the first Address resource record, search the DNS tree until you find this record. Expand the tree under the Zone object and look for an object with the host's name. This object will be the RRSet object for the host. Under the RRSet object, you will find another object that is named according to the host's IP address. This object is the resource record that you just defined.

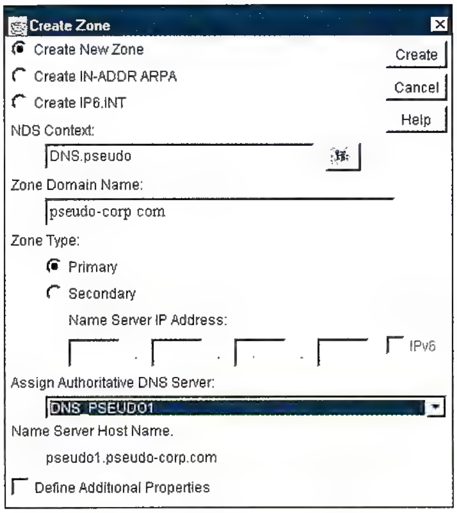
You do not directly create RRSet objects. The DNS/DHCP Management Console automatically creates, manages, and destroys RRSet objects as needed.

Creating Pointer Resource Records

If you have created an IN-ADDR.ARPA zone, the DNS/DHCP Management Console creates a Pointer record to match each Address record that you create. Unfortunately, the DNS/DHCP Management Console does not automatically delete a Pointer record when you delete the corresponding Address record. You must remember to manually delete the Pointer resource record.

If Pointer resource records are being created for you by the DNS/DHCP Management Console, you may never need to create them manually. However, Address and Pointer resource records do get out of sync, so you'd better be prepared to do the job manually. To create a Pointer resource record, you complete the following steps:

1. Select the DNS tab in the DNS/DHCP Management Console's screen.
2. Select the IN-ADDR.ARPA Zone object under which you will create the Pointer resource record.



● Create New Zone
○ Create IN-ADDR ARPA
○ Create IP6.INT
NDS Context: DNS.pseudo
Zone Domain Name: pseudo-corp com
Zone Type:
● Primary
○ Secondary
Name Server IP Address: . . . ☐ IPv6
Assign Authoritative DNS Server: DNS PSEUDO1
Name Server Host Name. pseudo1.pseudo-corp.com
☐ Define Additional Properties

Figure 7. *In the Create Zone dialog box, you can create forward-naming zones and reverse-naming zones.*

3. Click the Create button in the toolbar.
4. Select Resource Record in the Create New DNS Record menu.
5. The Create Resource Record dialog box for an IN-ADDR.ARPA zone appears. Select the PTR radio button.
6. The network address portion of the IP Address field is completed based on the definition of the IN-ADDR.ARPA zone. You must complete only the host ID portion of the IP address.
7. In the Host Name field, enter the host's name.
8. In the Domain field, enter the name of the host's domain.
9. Click Create.

After creating the first Pointer resource record, locate it in the IN-ADDR.ARPA zone. The resource record is created under an RRSet object. In an IN-ADDR.ARPA zone, the RRSet object takes its name from the host ID portion of the host's IP address. For example, an RRSet object with the name 45 in the zone 1.168.192.IN-ADDR.ARPA is associated with the host that has the IP address 192.168.1.45.

Creating Name Server Resource Records

Name Server resource records are required for both forward-naming and IN-ADDR.ARPA zones. Unless at least one Name Server resource record is placed in a zone, no DNS server is authoritative for the zone, and the zone is nonfunctional.

Ordinarily, you don't manually create Name Server resource records. Instead, you select a Zone object and add DNS servers to the Authoritative Name Servers list.

The DNS/DHCP Management Console creates and destroys Name Server resource records as you add or remove DNS servers in this list.

Although the DNS/DHCP Management Console creates Name Server resource records, it does not create the Address records for a DNS server. In addition to having a Name Server resource record, each DNS server must be defined by an Address record that corresponds to the server's DNS name. A DNS server is defined by a Name Server resource record in each zone over which the server has authority and an Address resource record in the server's own domain. (See Figure 5 on p. 34.)

Modifying Resource Records

Actually, that was a trick heading because once a resource record is defined, you can make few changes to it. If you select a resource record and examine its detail parameters, you will find that most (probably all—I haven't checked every type of resource record) parameter fields cannot be edited. Either the fields are grey, indicating that they cannot be modified, or they are white but refuse to accept changes. In other words, to modify a resource record, you must delete the resource record and recreate it with the new settings.

However, the RRSet object contains two fields that can be modified:

- **Associated NDS Object.** In this field, you can specify an existing NDS object that corresponds to a host. This field is informational only. It doesn't affect the operation of the DNS service.
- **Comments.** You can enter a comment for each RRSet object.

You cannot modify the name of an RRSet object. To change the name, you delete the RRSet object and recreate it.

STARTING AND STOPPING THE DNS SERVER SERVICE

After you have defined a DNS Server object and at least one zone for which the DNS server has authority, you can activate the DNS service on the NetWare 5 server. Simply load NAMED.NLM on the NetWare 5 server. (NAMED stands for Name Daemon. A *daemon* is a background process that runs on a UNIX computer, and *NAMED* is the command that starts the DNS service on most Unix DNS servers.) The DNS Server process runs in the background and activates a status screen that you can access by pressing the Ctrl-Escape keys or the Alt-Escape keys.

By default, verbose messaging is turned off. You can enable verbose messaging by loading NAMED.NLM with the –V option. The –Q option turns off verbose messaging. Verbose messaging reports DNS server activity in detail and can negatively affect server performance. You should use the –V option only when troubleshooting.

The NAMED.NLM has several other options, and you can load NAMED.NLM re-entrantly with different options to make changes to the configuration of the DNS service. Some options enable you to import zone data from BIND database files, a topic that is beyond the scope of this article. The –S option displays a status report for the DNS service. The VI *zone* option forces the DNS service to update its records for a zone. (Zone specifies the name of a zone.) The –H option displays the command syntax for NAMED.NLM along with a complete list of options.

You can unload NAMED.NLM to stop the DNS service. You can also pause and resume the service by selecting a DNS Server icon in the DNS/DHCP Management Console and clicking the Start/Stop Service button in the toolbar. The Start/Stop Service button does not unload and reload NAMED.NLM. This button simply pauses the DNS service or causes it to resume operation. When the DNS Server service resumes, it reinitializes itself from the appropriate zone databases.

CONFIGURING NETWORK CLIENTS TO USE DNS

Finally, you must also configure network clients with the IP addresses of one or more DNS servers. The easiest way to configure clients is to use DHCP, but you can also configure clients by using static parameters.

To configure a Windows NT, 98, or 95 client on a TCP/IP network to use DNS, open the Network dialog box in the Control Panel. Then complete the steps for the operating system you are using:

- If you are using Windows 98 or 95, select the TCP/IP protocol that binds to your network adapter, and click Properties.
- If you are using Windows NT, select the Protocols tab. Next, select TCP/IP and click Properties. Then select the DNS tab.

For Windows NT, 98, or 95, configure the following fields on the DNS tab:

- **Enable DNS.** Select this radio button.
- **Host.** In this field, enter the client's DNS host name.
- **Domain.** In this field, enter the client's DNS domain name.
- **DNS Server Search Order.** In this field, add the IP addresses of the DNS servers the client should use. You must add the DNS servers in order of priority. You cannot adjust the order after the addresses are entered.
- **Domain Suffix Search Order.** In this field, add the names of any domains that the client should search to resolve a name. For example, suppose this field contains the entry pseudo-corp.com and the client attempts to resolve the name *charly*. If the client cannot resolve charly, the client will attempt to resolve the name charly.pseudo-corp.com.

To configure a DOS client on a NetWare 5 network to use TCP/IP, you search for the RESOLV.CFG file, which resembles the following:

```
domain pseudo-corp.com
nameserver 192.168.1.1
```

You then edit this file as required to specify the host's domain and DNS server.

CONCLUSION

You now know how to implement a basic but functional DNS server using the DNS services in NetWare 5. If you are managing a small network, the information in this article may be all you require. If you are managing a complex network, you probably need to go beyond the basics.

The next article in this series will go beyond the basics. It will describe a few more types of resource records and explain how to extend the scope of a DNS service to support large and geographically distributed organizations. The next article will also explain how to support name spaces that include child zones and will provide some diagnostic techniques that you can use to troubleshoot a DNS service.

Drew Heywood is a network administrator who spends most of his time writing books and articles about networking. He is the author of several books including Novell's Guide to TCP/IP and intraNetWare, *which is published by Novell Press.* ●

Novell's Stamp of Approval

Kimberly Jones

If your company is planning to upgrade to NetWare 5, you probably want to know what third-party products support NetWare 5. Fortunately, Novell has done most of the work for you. Through the Yes, Tested and Approved program, Novell tests third-party products and ensures that these products support Novell products, such as NetWare 5.

You will be happy to know that Novell has certified hundreds of third-party products for use with NetWare 5. Because we cannot feature all of these products in one issue, we periodically highlight several products in "Product Focus." (See "Product Focus: Products That Support NetWare 5," NetWare Connection, *Sept. 1998, pp. 20–22. You can download this article from http://www.nwconnection.com/sep.98/focus98.)*

This article features software products that seem particularly useful in helping you manage a network. All of these products have received Novell's Yes, Tested and Approved certification for NetWare 5. To view a complete list of products that have been Yes, Tested and Approved for use with NetWare 5, visit Novell's DeveloperNet World-Wide Web site (http://developer.novell.com/infosys/bulletn.htm).

ALEXANDER SPK 3.0

Alexander Server Protection Kit (SPK) 3.0 from Alexander LAN Inc. is a NetWare Loadable Module (NLM) that automates crash prevention for NetWare 5, NetWare 4, and NetWare 3 servers. With Alexander SPK 3.0, you can reduce the number of crashes, thus improving server reliability. Alexander SPK 3.0 detects an impending crash and, in many cases, prevents the crash from occurring by putting the unstable software to "sleep." You can then unload and reload this software without restarting the server.

If an impending crash cannot be prevented, Alexander SPK 3.0 automatically dismounts volumes to protect the data stored in these volumes. In addition, Alexander SPK 3.0 recovers the server, restarts NetWare, and reports the crash to any industry-leading network management console, such as Novell's ManageWise.

Alexander SPK 3.0 also gathers diagnostic information about the crash and uses this information to create a comprehensive crash file. The crash file identifies the software that caused the crash and recounts the state the server was in immediately before the crash occurred.

You can download a 30-day trial version of Alexander SPK 3.0 from http://www.alexander.com/forms/30day/30day.html. For more information about Alexander SPK 3.0, visit Alexander LAN's World-Wide Web site (http://www.alexander.com). You can also call 1-603-880-8800.

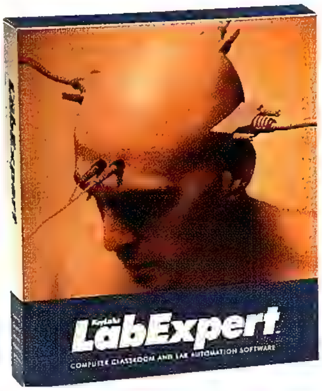
DS EXPERT 2.7

DS Expert 2.7 from NetPro Computing Inc. is a client-server utility that enables you to monitor your company's Novell Directory Services (NDS) database from a Windows NT, 98, 95, or 3.x workstation. When DS Expert 2.7 detects an NDS problem, such as a replica synchronization error, DS Expert 2.7 automatically displays an alert and reports the problem to third-party paging products and network management consoles.

DS Expert 2.7 is different than other NDS monitoring products, which typically monitor NDS events. With DS Expert 2.7, you receive an alert only when an NDS problem occurs, rather than receiving an alert every time a change is made to the NDS database. As a result, you don't have to sort through meaningless alerts that fail to specify what these changes mean. DS Expert 2.7 provides clear information that explains the location and the type of each NDS problem.

DS Expert 2.7 also helps you determine whether the NDS database is healthy before you modify it. If all of the lights in DS Expert 2.7 are green, you know that you can safely proceed with the change. DS Expert 2.7 then notifies you once the change is successfully completed. DS Expert 2.7 even displays a real-time graphical view of the NDS tree, which allows you to ensure that everything is functioning properly.

NetPro Computing plans to release DS Expert 2.7 in the second quarter of 1999. You can download an evaluation version of DS Expert 2.6 from http://www.netpro.com/survey/novellwiz2.htm. For more information about DS Expert 2.7, visit NetPro Computing's web site (http://www.netpro.com). You can also call 1-800-998-5090 or 1-602-941-3630.



Altiris' LabExpert 3.2

LABEXPERT 3.2

LabExpert 3.2 from Altiris Inc. is an NLM that you can use to quickly change the configuration of multiple workstations simultaneously. LabExpert 3.2 is designed for computer training centers, computer labs, and other companies that must frequently configure multiple workstations. (See "LabExpert 2.21: Configuring Multiple Workstations," *NetWare Connection*, Mar. 1998, pp. 33–38. You can download this article from http://www.nwconnection. com/nwc/mar.98/labxprt38.)

LabExpert 3.2 includes the ImageBlaster Agent, which allows you to create an ideal configuration on one computer and to copy an image of this configuration to other computers across your company's network. LabExpert 3.2 also includes ImageExplorer, which allows you to view and modify the images you have created with the ImageBlaster Agent. In addition, LabExpert 3.2 includes BootWorks Disk Wizard, which allows you to automate configuration tasks.

You can download a 30-day trial version of LabExpert from http://www.altiris.com/software/labexpert. For more information about LabExpert 3.2, visit Altiris' web site (http://www.altiris.com). You can also call 1-888-252-5551 or 1-801-377-5484.

TIVOLI MANAGEMENT AGENT 3.6

Tivoli Management Agent 3.6 is an NLM that allows you to manage NetWare 5, NetWare 4, and NetWare 3 servers by using one of Tivoli System's network management products, such as Tivoli Enterprise. This NLM enables NetWare to be "Tivoli-Ready," enabling you to more effectively manage NetWare severs via Tivoli Enterprise software. Tivoli Management Agent 3.6 is a lightweight version of Tivoli Management Framework, which provides a common foundation for all of Tivoli's network management products.

If you install one of Tivoli's network management products on your company's network, you must also install Tivoli Management Agent 3.6 on each server you want to manage. Tivoli Management Agent 3.6 serves as the client software, gathering information about the server and sending this information to the network management product you are using. (Tivoli Management Agent 3.6 is included with Tivoli's management products.)

Although Novell has its own management platform, ManageWise, the company also wants to support its customers who use Tivoli's management platform. In December 1998, Novell and Tivoli Systems Inc. announced a joint initiative to integrate NDS and Tivoli Enterprise Management Systems. This partnership is designed to simplify network management for customers who rely on NetWare and Tivoli Enterprise Management System to run their company's networks. (You can download more information about the Novell and Tivoli joint initiative from http://www.novell.com/press/archive/1998/12/pr98153.html.)

For more information about Tivoli Management Agent 3.6, visit Tivoli Systems' web site (http://www.tivoli.com). You can also call 1-800-2-TIVOLI or 1-512-794-9070.

WEBCONSOLE 3.0

WebConsole 3.0 from HiTecSoft Corp. is an NLM that allows you to securely manage your company's network through a web browser that supports frames, such as Netscape Navigator or Microsoft Internet Explorer. With WebConsole 3.0 you can access and manage NetWare 5, NetWare 4, and NetWare 3 servers from a workstation that has an Internet connection and a web browser.

Because WebConsole 3.0 is fully compatible with NDS and the NetWare 3 bindery, you can use Web Console 3.0 to perform any network management tasks for which you have rights. (See "NDS-Enabled Applications: What Do They Have That Other Applications Don't?" *NetWare Connection*, Aug. 1998, pp. 6–18. You can download this article from http://www.nwconnection.com/aug.98/nds.) After authenticating to NDS, for example, you can create, delete, and modify NDS objects. You can also view the server console screen, load and unload NLMs, mount and dismount volumes, and edit server configuration files, such as the AUTOEXEC.BAT file and the STARTUP.NCF file. In fact, WebConsole 3.0 allows you to perform many of the same network management tasks that you can perform by using Novell's NetWare Administrator (NWADMIN) utility and other utilities that run at the server console.

You can download an evaluation version of WebConsole 3.0 from http://www.hitecsoft.com/html/webcon_eval.htm. For more information about WebConsole 3.0, visit HiTecSoft's web site (http://www.hitecsoft.com). You can also call 1-602-970-1025.

INFOBOOK 2.7

InfoBook 2.7 from Divya Inc. is a Java-based application that runs on any server with a Java virtual machine (JVM), including a NetWare 5 server. With infoBook 2.7, you can configure a GUI for presenting text and multimedia information. For example, you could use infoBook 2.7 to create an online product catalog, resume database, or telephone book.

InfoBook 2.7 offers more than 70 configuration parameters, which you can use to customize a GUI that meets your company's needs. You can incorporate multimedia files in this GUI, including image files, audio files, and video files. You can also take advantage of Common Gateway Interface (CGI) scripting capabilities and data accessibility via JavaScript.

You can download an evaluation version of infoBook 2.7 from http://www.divya.com/products/infoBook/Download.html. For more information about infoBook 2.7, visit Divya's web site (http://www.divya.com). You can also call 1-703-834-5390.

BINDVIEW EMS/NOSADMIN 6

BindView Enterprise Management System (EMS)/Network Operating System Administrator (NOSadmin) 6 from BindView Development Corp. is a client-server utility that allows you to manage the security and integrity of your company's network from a Windows NT, 98, 95, or 3.x workstation. You can use BindView EMS/NOSadmin 6 to isolate and troubleshoot security risks and configuration problems.

With BindView EMS/NOSadmin 6, you can conduct a complete security assessment of the entire network, analyzing passwords, users' rights, network administrators' rights, and the NDS tree. For example, you could determine who has rights to access mission-critical data and how these rights flow down the NDS tree. You could then revoke rights for users who do not need to access the data.

You can also use BindView EMS/NOSadmin 6 to analyze configuration issues, such as SET parameters and hard drive space usage. In addition, you can compare the configuration of each server against your corporate standards, and you can add, delete, or update NLMs or other files across multiple servers. You can even use the configuration tools that come with BindView EMS/NOSadmin 6 to deploy Novell's AUDITCON utility, and you can generate query- and presentation-level reports based on the information the AUDITCON utility gathers.

BindView Development plans to release BindView EMS/NOSadmin 6 during the first quarter of 1999. For more information about BindView EMS/NOSadmin 6, visit BindView Development's web site (http://www.bindview.com). You can also call 1-800-749-8439 or 1-713-881-9100.

Kimberly Jones is a freelance writer and editor based in Chicago, Illinois.

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George Johnson

New NetWare 5 Self-Study Training Programs

You and the company you work for probably know how valuable it would be for you to update your networking skills and become NetWare 5 certified. However, you may also feel like you are too busy to leave your job and spend time traveling to training centers and attending NetWare 5 courses. To address the educational needs of busy networking professionals such as you, Novell Education recently announced the NetWare 4.11 to NetWare 5 Update self-study training program and the NetWare 5 Self-Study CNE Training program.

THE NEED FOR SELF-STUDY PROGRAMS

These self-study programs make NetWare 5 training manuals, videos, networking simulations, and other helpful reference materials available to you whenever and wherever you need them. You have the luxury of completing courses when you have time to study, and you can set your own pace: You can spend more time on the issues you find challenging and less time on the concepts that you grasp immediately.

Ptarmi Kilgore, self-study program manager at Novell Education, explains why Novell has begun offering these self-study programs: "Almost one half of the students taking Novell certification tests are choosing alternatives to instructor-led training. These professionals are demanding diverse and flexible training options that fit their busy schedules and meet their specific training needs."

WHAT IS INCLUDED IN THE SELF-STUDY PROGRAMS

The self-study programs are designed to meet the increasing demand for a comprehensive set of NetWare 5 training materials. Each self-study training program includes printed training manuals, the Interactive Learning CD, and a three-user version of NetWare 5. The new self-study programs address a variety of topics, including the following:

- NetWare 5's unlimited scalability
- Pure IP connectivity
- Improved security
- Leveraging Novell Directory Services (NDS)
- Reducing network management costs
- Application deployment using Zero Effort Networks (Z.E.N.works)
- Developing applications for and running the world's fastest Java Virtual Machine (JVM)

THE INTERACTIVE LEARNING CD

The Interactive Learning CD is designed to give self-study students the advantages of interactive training. "Knowing that students have historically done extremely well in Novell's instructor-led courses, we have created interactive training software for the self-study programs to provide experiences similar to the classroom learning experience," says Steve Rife, Novell Education product development program manager.

The Interactive Learning CD includes three powerful training programs that provide hands-on experiences: NEXTSim™, Digital Videos, and Challenge!Interactive™. Each program on the Interactive Learning CD is linked to a specific area in the training manuals. These training programs are explained below:

- **NEXTSim** gives you hands-on task simulations that mimic actual NetWare 5 networking scenarios, improving your ability to manage a real NetWare 5 network.
- **Digital Videos** contain video segments that are directly tied to key NetWare 5 concepts found in the training manuals. The videos provide visual reinforcement of these concepts and other technical procedures. Digital video presentations are similar to watching and listening to a trainer in a traditional classroom.
- **Challenge!Interactive** is a pre- and post-course assessment program. Challenge!Interactive provides a database of questions to test your comprehension of the course content. If you are unsure of the answer to a question, Challenge!Interactive directs you to the corresponding topic in the training manual.

If you are just beginning the CNE certification program, the NetWare 5 Self-Study CNE Training program will prepare you for each of the exams required for NetWare 5 certification. For a complete list of exams, visit Novell Education's World-Wide Web site (http://education.novell.com). If you need to update your CNE certification from NetWare 4.11 to NetWare 5, the NetWare 4.11 to NetWare 5 Update self-study training program will prepare you to take exam number 050-638.

You can purchase the NetWare 4.11 to NetWare 5 Update (available now) and NetWare 5 Self-Study CNE Training (available at the end of February) programs through a Novell Authorized Education Center (NAEC) or a Novell authorized reseller. For more information, visit Novell Education's web site (http://education.novell.com) or call 1-800-233-3382 or 1-801-222-7800. ●

Preparing Your Network for Upgrades

Mickey Applebaum

Editor's Note: Technically Speaking answers your technical questions, focusing on network management issues. To submit a question for a future column, send an e-mail message to nwc-editors@nwconnection.com, or send a fax to 1-801-228-4576.

Novell recently released NetWare 5, NetWare 4.2, and NetWare 4.2 for Small Business. If you are planning to upgrade an existing server to one of these new versions of NetWare, you obviously want to ensure that the upgrade process goes smoothly and users are not negatively impacted by the upgrade. This article explains what you should do to prepare for a network operating system upgrade, including the research you should do and the steps you should take to avoid potential problems.

CHOOSING AN UPGRADE METHOD

When you plan a network operating system upgrade, the first thing you must decide is what upgrade method you will use: You can perform an in-place upgrade using your company's existing server hardware or an across-the-wire migration using new server hardware. If possible, you should perform an across-the-wire migration. This upgrade method is preferable because the existing server is still intact if a problem occurs during the upgrade process. In other words, you will not have any down time due to an upgrade glitch.

In addition, new server hardware usually offers increased disk capacity, more RAM, and the latest LAN/WAN technology. As a result, new server hardware improves the performance and reliability of the network. (If you are planning to use existing hardware, see "Finding the Latest Drivers for Your Company's Server Hardware" on p. 44.)

CHOOSING NEW HARDWARE

Unfortunately, you can't always upgrade all of your server hardware each time you upgrade your network operating system. However, you can often add new disk controllers, network interface boards, RAM, or CPUs when you upgrade.

Like most software upgrades, new versions of NetWare typically use more RAM than older versions use. Now is the time to add more memory to the server hardware. Keep in mind that it's virtually impossible to have too much RAM in a NetWare 5 or NetWare 4 server, thus more is better.

If the server hardware supports CPU upgrades (such as upgrading from a 486 processor to a Pentium processor), you should upgrade the CPU now. You may also want to consider adding one or more CPUs if the server hardware supports multiple processors. If you decide to add CPUs, you must ensure that the manufacturer of the server hardware has a properly supported Platform Support Module (PSM) for the version of NetWare to which you are upgrading.

When you purchase any new hardware for your company's network, you should use the following guidelines:

- Check Novell's Yes, Tested and Approved bulletins to find products that are certified for the NetWare operating system you are installing. (To find out what products Novell has certified, visit http://developer.novell.com.) By using server hardware that is Novell Yes, Tested and Approved, you can avoid incompatibility problems.
- Avoid "no-name" adapters and computers from manufacturers that do not provide direct support. You may find that getting support or updated drivers is impossible.
- Check with the manufacturers of the other products you use to ensure that there are no compatibility issues with the new hardware or the new version of NetWare. For example, you will probably need to upgrade your company's backup software when you upgrade to the new version of NetWare. You must ensure that the backup software is compatible with the new Host Adapter Module (HAM) and Custom Device Module (CDM) drivers for the host adapter you use. If the backup software is not compatible with these drivers, the backup software may not recognize your tape drive.

  Another potential conflict may exist with your antivirus software. If the antivirus software is not compatible with the new version of NetWare, this software may abend the server. You should resolve issues such as these before you begin the upgrade process.

If you purchase new hardware, you should read the documentation for this hardware. You should also find out if the hardware requires any new support files for the new version of NetWare.

RESOLVING OUTSTANDING PROBLEMS

You should also resolve any outstanding conflicts or operability issues before you begin the upgrade. For example, your existing server may be reporting memory errors because the server hardware is not reporting the proper RAM size to NetWare. To fix this problem, you may now use the REGISTER MEMORY command before you load drivers and mount volumes in the AUTOEXEC.NCF file. If you do not resolve outstanding conflicts such as this one before you begin the upgrade process, you may not be able to complete the upgrade process successfully. (For more information about memory errors, see "Technically Speaking: Memory Fragmentation and Segmentation," *NetWare Connection*, Apr. 1998, pp. 41–42. You can download this article from http://www.nwconnection.com/apr.98/techsp48.)

IMPLEMENTING THE LATEST PATCHES AND UPDATES

Finally, remember that no version of any operating system is perfect. Before you begin the upgrade process, you should check the Novell Support Connection World-Wide Web site (http://support.novell.com) for any updates and patches that are available for the version of NetWare to which you are upgrading. You will want to install the available patches and updates before users log in to the server and experience any problems.

BACKING UP YOUR CURRENT SERVER

Before you begin the upgrade process, it is critical that you create two complete backups of the server. If the upgrade process fails, you will then be able to recover the server and all of your company's data. (For more information about creating a complete backup of your server, see "Backing Up NDS," *NetWare Connection*, Aug. 1998, pp. 43–45 and "Backing Up the NetWare File System," *NetWare Connection*, Sept. 1998, pp. 38–42. You can download these articles from http://www.nwconnection.com/aug.98/techsp88 and http://www.nwconnection.com/sep.98/techsp98, respectively.)

CONCLUSION

Upgrading to a new version of NetWare does not need to be difficult if you take the time to plan the upgrade properly. If you don't rush and don't cut corners, the upgrade process will go smoothly. You must identify all of the driver updates, firmware upgrades, and hardware changes you will need well in advance so that you will have time to implement all of these updates. And you should find out before you begin the upgrade if you need to replace hardware that is no longer supported by the manufacturer. Most importantly, you must make sure you have two verified backups before proceeding with the upgrade.

For more information about upgrading your network operating system, you may find the following documents helpful:

- "NetWare Peripheral Architecture," *Novell AppNotes*, Sept. 1998. This article describes NetWare Peripheral Architecture (NWPA), Novell's latest driver technology. You can download this document from http://developer.novell.com/research/appnotes/1998/septembe/01/07.htm.
- YES Program Certification Bulletin Category Index (http://developer.novell.com/infosys/bulletn.htm). This web site includes a search engine that you can use to find products that are Novell Yes, Tested and Approved for the version of NetWare to which you are upgrading.
- **NetWare 5 Release Notes.** This document provides configuration information, such as preferred settings and potential memory conflicts, for NetWare 5. You can download this document from http://support.novell.com/cgi-bin/search/tidfinder.cgi?2941992.

Mickey Applebaum has worked with NetWare for more than 14 years. Mickey provides technical support on the Internet for The Forums (http://theforums.com).

Finding the Latest Drivers for Your Company's Server Hardware

If you are upgrading your company's network operating system using existing server hardware, you should evaluate that hardware to ensure that you have the latest firmware and drivers for the operating system you are installing. For example, NetWare 5, NetWare 4.2, and NetWare 4.2 for Small Business fully integrate NetWare Peripheral Architecture (NWPA), Novell's latest driver technology. Using NWPA provides high performance and flexibility in adapter configurations.

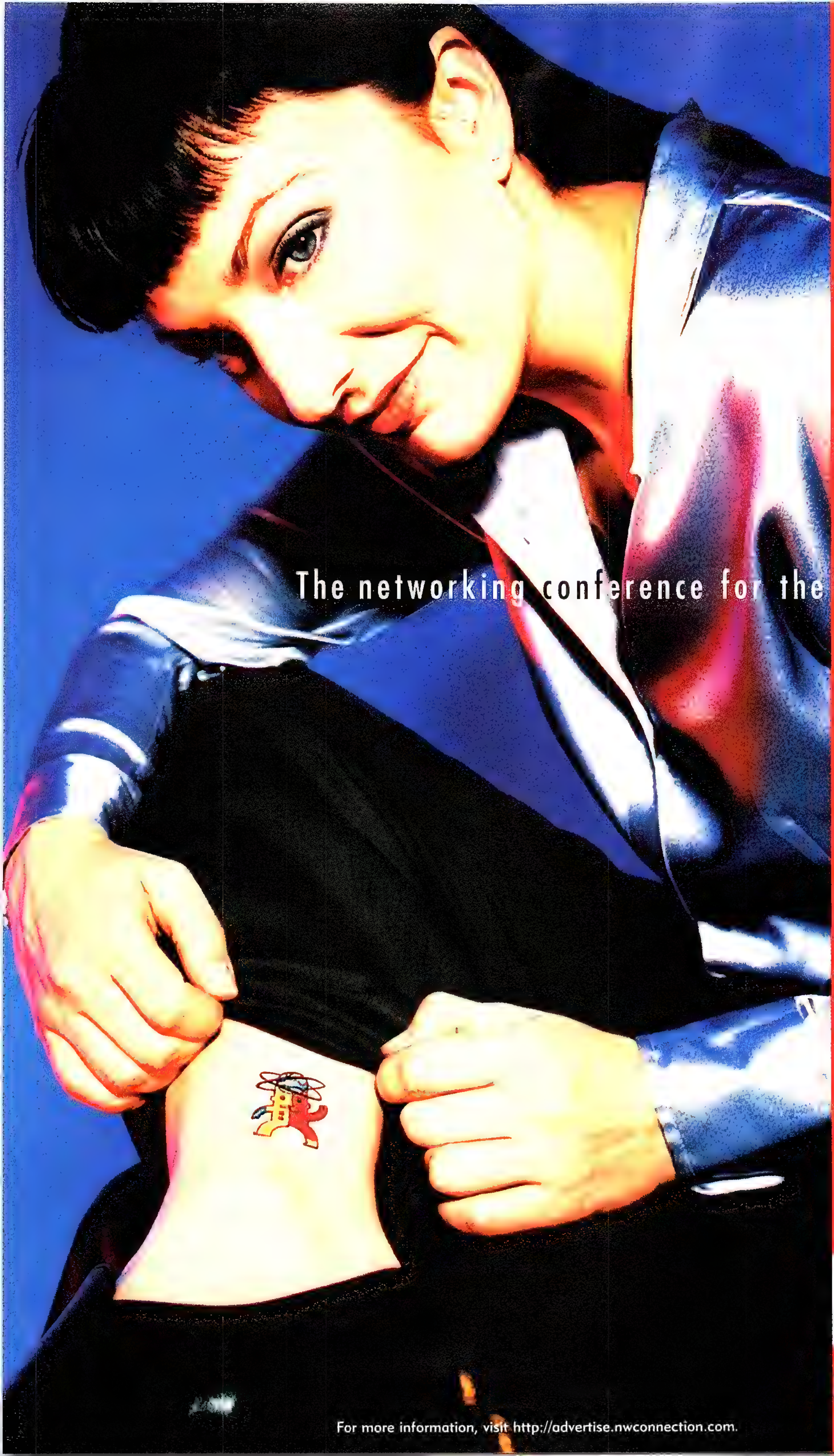
If you are upgrading to NetWare 5, NetWare 4.2, or NetWare 4.2 for Small Business, you should ensure that you have the new Host Adapter Module (HAM) and Custom Device Module (CDM) drivers. For example, NetWare 5 will probably not support the old .DSK driver you use for your hard disk controller. (For more information, see Technical Information Document [TID] 2942248. You can download this document from http://support.novell.com/cgi-bin/search/tidfinder.cgi?2942248.)

You should also ensure that the drivers support the hardware revisions for the adapters you use. If you are not sure that you have the right drivers and firmware, you should first set up a test platform to make sure you don't put your company's data at risk.

Finding out if you have the latest drivers for your hardware can sometimes be tricky. Of course, most hardware manufacturers have World-Wide Web sites on which you can search for drivers, firmware revisions, compatibility information, and other product update information. Unfortunately, in the past couple of years, the computer industry has experienced significant consolidation through acquisitions and mergers. As a result, the manufacturer of the disk controller or network interface board you are using may no longer be in business or may be a part of another manufacturer.

These changes can make finding driver updates difficult at best, impossible at worst. The following guidelines will help you find driver updates and get adapter support:

- If you can no longer find the manufacturer for your hardware, you can ask a reseller, support organization, or other independent support group for help in locating the manufacturer. (At the risk of promoting my own organization, The Forum provides this service. For more information, visit http://theforums.com.)
- If the manufacturer is no longer in business, it's time to replace that particular piece of hardware. Keep in mind that no manufacturer will write drivers for another manufacturer's hardware—especially if that hardware is obsolete.
- If the manufacturer has been acquired, you should check with the new manufacturer to see if it provides driver updates and product support. When a manufacturer acquires a product, the manufacturer will often support that product for a specified period of time. However, the manufacturer may also discontinue the product and not provide support, thereby saving both development costs and support costs.



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NetWare User Groups

Giving Back to the Community

Cecily Spencer

NetWare Users International (NUI) encourages NetWare user groups to participate in service projects that will benefit the people living in the user group's community. For example, NetWare user groups can use their considerable networking expertise to help schools and nonprofit organizations set up or maintain networks. This article describes the efforts of two NetWare user groups that organized service projects in their area.

BUILDING NETWORKS IN HAWAII

Last year, the Hawaii NetWare User Group learned that the U.S. government is sponsoring NetDay 2000, a national program intended to provide young people in kindergarten through twelfth grade with better access to and experience with computers. In response to this project, the Hawaii NetWare User Group recently welcomed several new members to its meetings. The new members are undergraduate and graduate students from the University of Hawaii at Manoa. These students, who are studying a computer-related field such as computer science, electrical engineering, mechanical engineering, or management information science, are working side-by-side with networking professionals to perform networking service projects for local schools.

The Hawaii NetWare User Group is currently involved in a project to collect and refurbish old personal computers and then donate the working computers to schools. In addition, the Hawaii NetWare User Group builds and refurbishes network labs that are located on the same island as the University of Hawaii at Manoa campus. For example, the Hawaii NetWare User Group recently built fiber optic backbones for the networks at Kaimuki Middle School and Wilson Elementary School. Working with the technical coordinators of several schools, the Hawaii NetWare User Group has also helped set up servers, labs, firewalls, and proxy servers on the schools' networks.

In addition, the Hawaii NetWare User Group is working on a project for the State of Hawaii Civil Defense team. The Hawaii NetWare User Group is helping to deploy a quadruple redundant e-mail delivery system, which will include leased lines, state-owned microwave lines, dial-up lines, and dial-on-demand satellite phones. When completed, this delivery system will be used to pass messages between disaster relief coordination centers statewide. The Hawaii NetWare User Group is also developing a customized Simple Network Management Protocol (SNMP) network management system that will monitor the status of the delivery system.

In addition to participating in networking service projects, student members of the Hawaii NetWare User Group attend Saturday workshops. A few students were also selected to attend NetWorld+Interop '98 in either Las Vegas or Atlanta to help build the show network. Experiences such as service projects and hands-on training provide the students with valuable information that helps them in their classwork and enables them to help in the Advanced Network Computing Laboratory (ANCL) at the University of Hawaii ICS Department. (For more information about ANCL, visit http://www.ics.hawaii.edu or http://ancl.ics.hawaii.edu.)

EDUCATIONAL GRANTS IN ILLINOIS

When the Illinois Valley Network Users Association (IVNUA) offered training seminars in February 1998, so many people attended the training seminars that profits exceeded IVNUA's expectations. As a result, IVNUA decided to give something back to its community. IVNUA invited local schools to apply for one of two grants, each in the amount of U.S. $500.

IVNUA set four guidelines for applications:

- Schools had to be nominated by an IVNUA member.
- The nominating member had to reside in the school's district.
- The school had to be a primary or secondary school (kindergarten through twelfth grade) located within 30 miles of La Salle, Illinois.
- Each winning school was required to use the funds to enhance the school's computer education program.

A total of seven schools, both public and parochial, submitted proposals to the IVNUA grant committee.

In September 1998, IVNUA awarded one $500 grant to Peru Catholic School, which is located in Peru, Illinois, and one $500 grant to St. Patrick's School, which is located in La Salle, Illinois. Peru Catholic School used the funds to help purchase a digital camera and color scanner for its computer lab. St. Patrick's School used the funds to purchase WordPerfect for its computer lab. In addition to providing the grant money, IVNUA offered free, one-year IVNUA memberships to all interested teachers or staff members from the seven schools that submitted grant applications.

NUI would like to thank all of the NetWare user groups that serve their community.

This article was written with the help of Brian Chee and Bill Quesse. Brian Chee is the associate director at the ANCL at the University of Hawaii at Manoa in the department of information and computer science. You can reach Brian at chee@hawaii.edu. Bill Quesse is a member of IVNUA and the director of computer services at Eureka Savings Bank. For more information about IVNUA's grant program, contact Bill at billq@eurekasavings.com.

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Online Column Connection

Who Are the People in Your Neighborhood?

Matthew Jones

With the Internet, you can access resources that are located throughout the world, all without leaving your home or office. But as you spend more and more time globe hopping, you may lose touch with the city in which you live. Fortunately, you can visit the World-Wide Web sites featured in this article to find resources that are located in your own backyard. You can then read about this month's games, and you can check out this month's new products. (See "Product Snapshots.")

WORLD-WIDE WEB SITES

If you want to explore a particular city and need somewhere to begin, your first stop should be City.net (http://www.city.net). City.net provides local information about cities worldwide. For each city you select, you can view a fact sheet that lists tax rates, crime statistics, and other details. You can also get restaurant recommendations, and you can read all about the recreation and entertainment options that are available. You can even use the Event Finder to search the Internet for information about upcoming events in whichever city you select.

If you want to become familiar with a particular city in the United States, you should visit USA CityLink (http://usacitylink.com). Although USA CityLink is restricted to cities in the 50 states, USA CityLink offers more extensive local information about these cities than City.net. For example, you can find local information about education, social services, and transportation. You can also discover things to do by viewing a list of libraries, movie theaters, museums, and recreation programs.

NETWORK RESOURCES

After you have checked out the resources in your community, you can become part of an online community—the WebChat Broadcasting System (http://www.wbs.net). The WebChat Broadcasting System provides hundreds of chat rooms, which you can enter to chat about a variety of topics with users who have similar interests. Whether you want to talk about politics, parenting, or pets, you can find a chat room that meets your needs. And a web browser is the only software you need to participate. Unlike many online communities, the WebChat Broadcasting System doesn't requite you to download and install any additional software, including plug-in software for your web browser.

STANDALONE GAME OF THE MONTH

Return to Krondor from Sierra Online is a sequel to the popular game, Betrayal at Krondor. Both of these games, which are based on a series of books by fantasy writer Raymond E. Feist, are set in Krondor, a city that is located in the fictional world of Midkemia.

The plot of Return to Krondor revolves around the Tear of the Gods, a mysterious relic of the Ishap religion. Sidi, a powerful sorcerer, has hired a band of pirates to steal the Tear of the Gods from an Ishapian treasure ship. In the process of trying to seize this relic, the pirates accidentally sink the treasure ship, sending the Tear of the Gods to the bottom of the Bitter Sea.

In Return to Krondor, you control five characters who are sent on a mission to recover the Tear of the Gods for the Ishap religion. (If you have read the series of books on which Return to Krondor is based, you are probably familiar with these characters.)

- Squire James, a reformed thief who is now a squire to the Prince of Krondor
- Jazhara, a young sorceress from the distant country of Kesh
- Brother Solon, a priest for the Temple of Ishap
- William ConDoin, captain of Krondor's city guard and son of the magician Pug
- Kendaric, a reluctant wizard whose magical powers are the group's only hope of victory

Together, these characters must locate the relic's resting place in the Bitter Sea and fight off the sorcerer's henchmen, who are also looking for the Tear of the Gods. Fortunately, the characters have many useful attributes, which improve as the game progresses. For example, each of the characters has a different level of agility, charisma, stamina, strength, and reason. Whenever a character wins a battle or solves a problem, the character gains experience points. You can then use these experience points to increase the character's skill level for one or more skills, such as brawling and lock picking, or to strengthen the character's magical powers.

Return to Krondor supports Windows 98 and Windows 95. You can purchase Return to Krondor through retail channels at the suggested retail price of U.S. $49.95. For more information about Return to Krondor, visit Sierra Online's web site (http://www.sierra.com). You can also call 1-800-757-7707 or 1-425-649-9800.

NETWORK GAME OF THE MONTH

StarCraft: Brood War from Blizzard Entertainment is the first official add-on game for StarCraft, one of the best-selling games of 1998. StarCraft: Brood War promises to be another big hit.

StarCraft: Brood War features three new campaigns for StarCraft. In the first campaign, you join the Protoss race in a quest to find their lost Dark Templar brethren, who can help rebuild the Protoss civilization. In the second campaign, you join Mengsk, the emperor of the Terran race, as he tries to ward off an attack by Kerrigan, the new queen of the Zerg race. In the third campaign, you join Kerrigan in trying to unify the Zerg race under her control so she can destroy both the Protoss and the Terran race.

If you can't follow these plots, you probably haven't played StarCraft yet. However, you cannot play StarCraft: Brood War unless you already own a copy of StarCraft.

In addition to offering three new campaigns, StarCraft: Brood War includes 26 new missions and more than 100 new multiplayer maps. StarCraft: Brood War also offers six new types of battle units, including lurkers, valkyries, and dark archons.

You can play StarCraft: Brood War in standalone mode or in multiplayer mode. If you select multiplayer mode, you can play against one person over a modem or a serial connection, or you can play against seven other people over a network or an Internet connection.

StarCraft: Brood War supports Windows NT, Windows 98, and Windows 95. (Blizzard Entertainment is planning to release a Power Macintosh version of StarCraft: Brood War early this year.) You can purchase StarCraft: Brood War through retail channels at the suggested retail price of U.S. $40. (If you have not already purchased StarCraft, you can purchase a set that includes StarCraft and StarCraft: Brood War at the suggested retail price of U.S. $60.) For more information about StarCraft: Brood War, visit Blizzard Entertainment's web site (http://www.blizzard.com). You can also call 1-800-953-7669 or 1-949-955-0283.

Matthew Jones is a manager in the Internet and e-commerce practice group of Waterstone Consulting, a business consulting and systems integration firm located in Chicago, Illinois. You can reach him at matthew@netfire.com. ●

Product Snapshots

When I am looking for the latest computer games, I often find new and interesting products. Product Snapshots gives you a quick overview of the most useful products I have found during the last month. (Please note that these are first-look reviews; I have not conducted exhaustive testing.)

DREAMWEAVER 2

Dreamweaver 2 from Macromedia Inc. is a robust, easy-to-use software program for designing World-Wide Web pages. With Dreamweaver 2, you can create a new web page or edit an existing web page by entering HyperText Markup Language (HTML) code or by dragging and dropping graphical items onto a WYSIWYG—what you see is what you get—display. As a result, you can create and edit web pages even if you don't know HTML.

Dreamweaver 2 offers so many features that this article cannot possibly list all of them. Some of the features that Macromedia has added since the last version of Dreamweaver include additional templates, advanced table editing capabilities, and global search and replace capabilities.

One of Dreamweaver 2's most useful features is its extensive third-party support. For example, you can use a number of third-party tags with Dreamweaver 2, including ASP, Apache, BroadVision, iCat, and Tango. You can even use your own custom tags. In addition, you can use several third-party objects with Dreamweaver 2, including Beatnik ActionSet, OpenPix, HotMedia, ColdFusion, and Live Picture.

You can also use a variety of third-party software programs with Dreamweaver 2. In fact, the Windows version of Dreamweaver 2 includes Allaire's HomeSite 4.0, and the Power Macintosh version includes Bare Bones Software's BBEdit 5.0. If you are already familiar with these HTML editors, you can use them to manipulate HTML code rather than using Dreamweaver 2's internal HTML editor. In addition, you can toggle between Dreamweaver 2's WYSIWYG display and the third-party HTML editor you are using.

Dreamweaver 2 supports Windows NT, Windows 98, and Windows 95. (Dreamweaver is also available for Power Macintosh.) You can purchase Dreamweaver 2 through retail channels at the suggested retail price of U.S. $269, and you can download a 30-day trial version free from http://www.macromedia.com/software/dreamweaver/trial. For more information about Dreamweaver 2, visit Macromedia's web site (http://www.macromedia.com). You can also call 1-800-326-2128 or 1-415-252-9080.

POINTCAST NETWORK 2.6

PointCast Network 2.6 from PointCast Inc. is the latest version of PointCast's free news and information service. PointCast Network 2.6 delivers news and information directly to your desktop through a series of channels, which work in much the same way as television channels. To view news articles, for example, you would select the National and Global channel.

To begin receiving content at your desktop, you simply install PointCast Network 2.6 on any computer with an Internet connection. You then configure PointCast Network 2.6, specifying the channels and the sources for which you want to receive content.

You can choose from 65 channels that provide various types of content, such as U.S. and international news, stock quotes, sports scores, and weather forecasts from around the world. You can choose to receive information from more than 700 sources, including CNN, the *Wall Street Journal*, and the *New York Times*.

You can customize the content you receive through the channels you have selected by creating personal news profiles. For example, if you selected the Companies channel, you could define the companies for which you wanted to receive content. You would then receive company-specific content for these companies, including press releases, performance reports, and stock quotes.

In addition to customizing the type of content you receive, you can customize the way you receive this content. You can configure PointCast Network 2.6 to deliver content only during the times you specify, such as once per hour between 8:00 a.m. and 5:00 p.m. Monday through Friday. You can also configure PointCast Network 2.6 to act as a screen saver, displaying headlines on your desktop after the computer has been idle for a specific amount of time. When you click on a headline with your mouse, you can instantly view the full news article.

PointCast Network 2.6 supports Windows NT, Windows 98, Windows 95, and Windows 3.1. You can download PointCast Network 2.6 free from http://www.pointcast.com/download. For more information about PointCast 2.6, visit PointCast's web site (http://www.pointcast.com). You can also call 1-408-990-7000. ●

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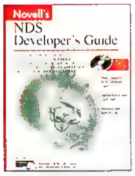
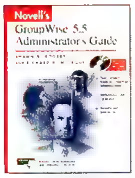


Novell's NDS Developer's Guide

Andrew, et al.
600pp ISBN: 45574
Retail Price: $59.99
Our Price: $44.99

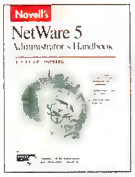
This guide demonstrates how to write network-aware applications for NDS. This guide is for intermediate- to advanced-level programmers working in COBRA, C, ActiveX, Visual Basic, Delphi, Java, and more. Bonus CD-ROM includes sample code from the book.



Novell's GroupWise 5.5 Administrator's Guide

Shawn B. Rogers and
Richard H. McTague
750pp ISBN: 45566
Retail Price: $44.99
Our Price: $33.74

This comprehensive guide for intermediate- to advanced-level administrators discusses the features new to GroupWise 5.5, such as the new Internet and e-mail features. Bonus CD-ROM includes white papers and a 3-user version of GroupWise 5.5.



Novell's NetWare 5 Administrator's Handbook

Kelley J.P. Lindberg
560pp ISBN: 45469
Retail Price: $39.99
Our Price: $29.99

This newly revised handbook to administering Novell networks covers all the essential procedures for installing, designing, and maintaining NetWare 5 networks. Also discusses native IP—the Internet protocol supported by NetWare 5.

Novell's Guide to Networking Hardware

Kevin Shafer
1358pp ISBN: 45531
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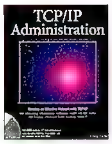

TCP/IP Administration

Craig Zacker
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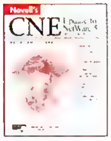

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David James Clarke, IV
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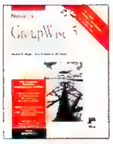

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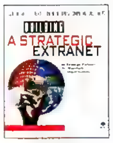

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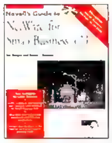

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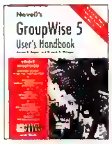

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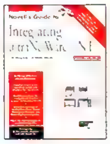

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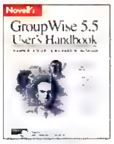

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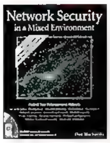

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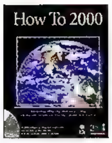

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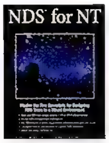

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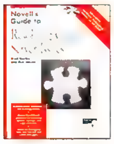

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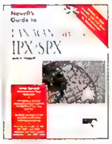

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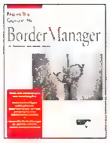

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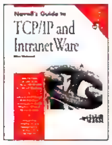

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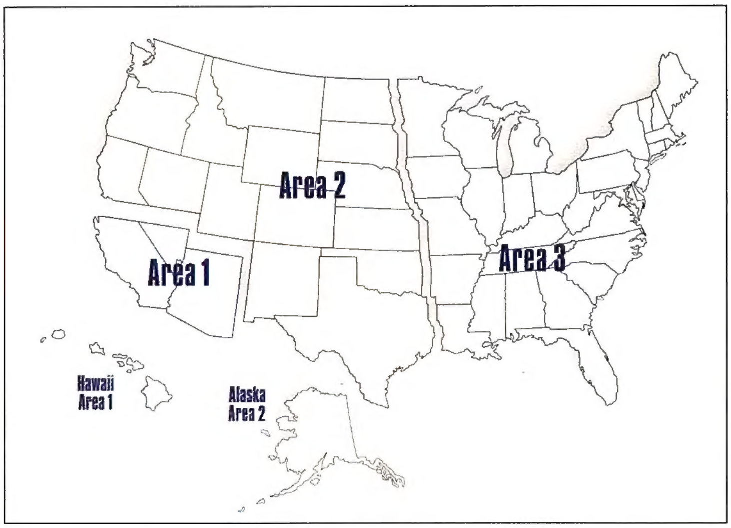

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SecureConsole V3 for NetWare 4 and 5

**30% think there's no problem
70% know there is.**

But the fact is, unless you take the right precautions, 100% of administrators will have problems with network security.

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